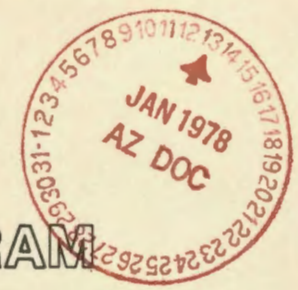

MANAGEMENT PROGRAM

GRAND CANYON NATIONAL PARK

ARIZONA

AN ADDENDUM TO THE

NATURAL RESOURCES MANAGEMENT PLAN

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

MANAGEMENT PROGRAM

AN ADDENDUM TO THE

NATURAL RESOURCES MANAGEMENT PLAN

FOR

GRAND CANYON NATIONAL PARK

Prepared By

GRAND CANYON NATIONAL PARK
NATIONAL PARK SERVICE
DEPARTMENT OF THE INTERIOR

September 1977

MANAGEMENT PROGRAM

The management program represents the action plan designed to implement the Natural Resource Management Plan for Grand Canyon National Park. It is a statement of funding, priorities and needs related to individual projects. The management program consists of:

A Resource Management Plan priority listing of research and management projects.

Natural Resources Project Statements that will serve as "blue prints" for proposed actions.

A Natural Resources Project programming sheet on which each project is shown in relation to park wide priorities, funding, and a time sequence for the 5-year period.

While the Natural Resources Management Plan is concerned with long-term park goals, the management program deals with a 5-year period only. The program presented here begins with Fiscal Year 1978. As projects are completed, or new projects proposed, the program will be updated annually for a new 5-year period. Progress on the plan and on the completion of individual project will depend on available funds in the park and from the Western Regional Office.

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PROJECTS PRIORITY LIST

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Ecological Information Base (GRCA-N-1)

3. STATEMENT OF PROBLEM: Grand Canyon National Park has a growing set of resource management problems which seem to compound themselves day by day. Many problems pre-exist the establishment of the park in 1919. By then, the basic layout and physical facilities of the park were fixed and a number of adverse uses were well established. Even today the problem with resources management exist at a relatively low priority. The park now has only one Resource Management Specialist and he is engulfed in paperwork; the new Research Unit is totally occupied on long-term crisis research without the time for proper attention to long-range goals; until very recently funding for resource management was nil and is still inadequate. Since the demise of the Civilian Conservation Corps in the early 1940's, there has been, and still continues to be, a low priority placed on resource management in comparison with visitor protection activities. The proportion of time and effort spent on resource protection has been in an inverse ratio to the number of park visitors, although the resource impact has been a direct ratio to visitation. Natural resource management is one area that is easily deleted from the operating program, since the consequences of neglect are only slowly felt.

   However, now in 1978, this neglect is apparent. The Service has been sued for mis-management on the Colorado River. Congress has deleted thousands of acres of the park, great pressure is being brought to bear for increased visitor accommodations, and for the export of water outside of the park. The lack of hard data input into Master Plans, Development Concept Plans, Environmental Impact Statements, and Construction Contracts means that all pressure groups are instant experts and are able to make proposals advantageous to themselves, since they know more about their area of special resource interest than does the park staff. Most Grand Canyon employees know little of the resource beyond the settled area. At best, there are only four or five people on the staff that would recognize a Peregrine Falcon (one of our endangered species) if they saw one, let alone where they are to be found. These people are little involved in the decisions about resource management or the utilization of natural resources. For all of these reasons, the park staff, as a whole, is unable to successfully meet the challenge of defending the long-established and ratified principles of resource management at Grand Canyon. Therefore, basic resource information is urgently needed.

4. WHAT HAS BEEN DONE: In the past, scattered and sporadic attempts have been made to gather resource information. To date, there has been no unified concerted effort to pull these scattered fragments together. Because Grand Canyon National Park was established some time ago, and because it is an area of considerable scientific interest, there is information available, but it is rather spotty and scattered. The Forest Service, Geological Survey, Bureau of Sport Fisheries and Wildlife, and several other Federal agencies have conducted some scientific work in the park from time to time, generally on very specific problems. In most cases, this work was geographically very confined. Private or university researchers have undertaken work in the park, again, in very limited geographical areas. A synopsis of where we stand follows:

   a. Geology. Because the Grand Canyon is one of the premier geological show cases of the work, geological studies are quite advanced. The stratigraphy is well known generally, although in some cases not in detail. Stratigraphic studies are too numerous to even cite the more important publications. The entire park has been geologically mapped, and this map is currently undergoing further revision. Canyon stratigraphy is therefore well enough known that further information for the R.B.I. will not be needed in the foreseeable future. The paleontology is less well known. The cost and effort involved in improving this data base will be enormous. Readily reached fossil localities have mostly been collected. There is enough information on this subject to give management the information necessary to identify and protect this resource, except in areas that are to be intensively developed. In the areas where significant development is to take place, detailed paleontological investigations should be undertaken as part of the EIS process.

   b. Hydrology and Water Resources. The hydrology and water resources of the park are not well known except on the broadest level. All significant sources of water that are large enough to be of economic interest are known. Only one list is known that enumerates some of the smaller and non-economic sources. Further information is needed about these because of their crucial importance to park wildlife and hiker safety. There is some information in hiker's logs and diaries, and this information should be pulled together and added to the results of field investigations.

      The scarcity of large, dependable water sources within the parks suggest several recommendations. First, development on the North Rim should be closely evaluated so it is not overextended beyond the limits of available water supplies. Second, water

supplies should not be exported outside the park. Third, the Park Service should remain abreast of any research or new information which would lead to the discovery of new, economical ground water supplies. Fourth, careful use of present water supplies should be encouraged.

c. Soils. The soils of Grand Canyon are unknown, with the exception of a few studies and very broad publications. A lack of information on soils has led to structural failures in the Shrine of the Ages Chapel and the new cabins at the South Rim auto lodge, and frequent problems with sewer and waterlines. Much information is needed on this subject and is not available in the literature.

d. Archaeology. There has been some work done on the archaeological resources of Grand Canyon. However, information is scattered and some of it was collected long ago and may now be invalid. Many of the old archaeological surveys need to be redone or verified because the location information was faulty. Also, much of the work done in the past does not conform to modern standards of location or nomenclature. Much of the data in the park files cannot, therefore, be related to current work. There is much information that is useful, but more needs to be done.

e. Plants. Fortunately, there has been considerable work done with the plants of Grand Canyon, but much of the work was done long ago before there was adequate transportation in the region. Plant collections were therefore limited to areas easily reached. For example, recent work in the riparian zone along the Colorado River has uncovered three taxa of plants new to science and 30 species not previously known from the park. These discoveries have all been related to the new ease of access to the river via raft trips. Large areas of the Grand Canyon proper and the North Rim have not been intensively collected. In 1936, the Civilian Conservation Corps completed a cover map for the park using a unique classification system developed by the National Park Service. Although this map is a remarkable accomplishment, considering the short length of time available for the project, the difficulties encountered such as the primitive transportation and no air photos, it is unsuited for use by modern management. Therefore, areas of plant study that need critical attention in a R.B.I. are vegetation mapping, floristics mapping of rare and endemic species, and the identification of habitat requirements. There are now two floras that cover the Grand Canyon. Therefore, plant identification will be simplified.

f. Vertebrates. Most of our knowledge about vertebrates present in the park comes from sight observation records, most of which are quite old, with very few recent additions. The park has a small collection of mammals and birds. These collections have largely resulted from accidental road kills. Reptiles and fish are largely unrepresented in the collection. Species distribution data, particularly of those taxa that are endemic, rare, or endangered, are badly needed. There is a semi-popular book on Grand Canyon mammals and a checklist of mammals, birds, and reptiles available. All of these lists are incomplete.

g. Invertebrates. Sporadic efforts in the past have resulted in a small insect collection for the park. This collection emphasized butterflies, at the expense of other taxa. A recent collecting trip in connection with the Colorado River Project yielded nearly 2,000 taxa new to the park. In the past, there has been a few publications on the insects of Grand Canyon. Other invertebrates are nearly unknown.

h. Ecology. Little ecological work has been accomplished at Grand Canyon, but we have an excellent study on the distribution of the pinyon-juniper and ponderosa pine on the South Rim. Other projects have been much less extensive. Grand Canyon lies in a unique ecological setting. It has a variety of biomes, and in some cases, lies in a central position along biome gradients. The canyon, therefore, is a place of great ecological interest. We hope that the R.B.I. will stimulate further research on the topic. At the present time, there are a number of ecological projects underway, most of them directed toward management problems. To date, there has been little published on Grand Canyon ecology.

i. Adverse Uses. The history of adverse use at Grand Canyon appears only briefly and in scattered form. Much of the material that tells how it is, how it was, and why it was, lies in archival documents and park files. The history of the inseparable management components: politics and resource management, needs preparation.

5. DESCRIPTION OF THE WORK TO BE UNDERTAKEN: We propose to undertake an inventory of the natural resources of the park stepwise by priority. We use the term "inventory" to include the type of resource present, the number of individuals that comprise the resource, and the location of the individuals or components of the resource. As the Resource Basic Inventory is now designed, the thematic thread that runs through the project is a geographical one. Wherever possible, data

is to be organized, stored, and retrieved geographically through the use of Universal Mercator Grid coordinates. Such a scheme will permit the organization and recall of diverse types of data.

The project will be pursued in a priority order through the use of three priority tables, each having equal weight:

a. Geographic Priorities.

1. Area west of South Rim Village.
2. Desert View area.
3. North Rim Village.
4. North tier of sections along north boundary.
5. Area one-half mile each side of north entrance road.
6. Park areas under special permit or adverse use.
7. South Rim undeveloped.
8. North Rim undeveloped.
9. Tuweep and Toroweap area.
10. Grand Canyon above the Inner Gorge.

b. Taxonomic Units

1. Bibliography.
2. Vegetation (not floristics).
3. Water resources.
4. Mammals.
5. Birds.
6. Soils.
7. Insects.
8. Reptiles.
9. Flora.
10. Fish.
11. Other invertebrates.
12. Archaeological resources.
13. Historical geological resources.
14. Geological resources.

c. Risk Type

1. Impacted or developed areas.
2. Rare or endemic units.
3. Things out of place through natural processes.
4. Other.

Using this list, R.B.I. project priorities are calculated:

a + b + c equals R.B.I. priority

The highest priority would be 1 + 1 + 1 equals 3 or "bibliography of impacted or developed areas west of the Grand Canyon Village." The next priority with level would be: a + b + c equals 4. This could be:

1 + 1 + 2 bibliography of endangered features west of Village or 1 + 2 + 1 vegetation of impacted areas west of Grand Canyon Village or 2 + 1 + 1 bibliography of impacted areas in Desert View area.

As the priority number increases, so does the number of possible projects, each having the same priority. Therefore, projects should be combined where possible. For example, there is little sense in making a literature search for endangered features west of Grand Canyon Village while ignoring all other citations relevant to the park. The bibliography portion of the project for the entire park could be completed in nearly the same length of time as would be needed for the target area; the western portion of the South Rim. So, the bibliography, in effect, becomes the number one priority. Such priority combination will reduce the list of projects considerably.

This method of data gathering will be dependent upon the type of subject matter under study at the moment. The project will involve a good deal of field work and will involve the collection of document tion specimens and materials where such methods do not conflict with the 1973 Endangered Species Act or significantly impact rare features of the park. All field data is to be stored on computer. This work will be done in the Grand Canyon Ecological Studies laboratory.

6. LENGTH OF TIME NEEDED: If all phases of this project are carried out, and if only 10 minutes per acre for the entire park complex is taken, the project will run something on the order of 100 man years. The 100 man-year figure is obviously much too high to be of interest to management. In reality, therefore, the lower priorities of the R.B.I. will probably not be undertaken during the course of this study. We propose a 6-year time limitation on the Resource Basic Inventory. This 6-year period should allow us to consider the first five or six items under each of the topics in the priority table. Certainly, the achievement of this goal will give management most of the data that will be required in the foreseeable future for the management of the natural resources of the park.

7. WHAT WILL HAPPEN IF THE PROJECT IS NOT UNDERTAKEN: We will continue to have inadequate data for input into the planning process. We can therefore assume that there will continue to be unfortunate and unforeseen results from future management activities. This will

result in as untenable situation and we will continue to be involved in a series of interim and crisis management decisions.

8. WHAT ARE THE ALTERNATIVES: The management and planning process can continue as it now exists with consequent results being those that now exist. Alternatively, the project can be delayed until pressure groups, political pressure, or court action forces us to take inventory action for input into planning documents.

9. WHO WILL ACCOMPLISH THE PROJECT: A considerable portion of the project will be undertaken by Research Scientist at Grand Canyon National Park. When our manpower or expertise is not sufficient, portions of the project will be let out on contract to independent investigators. The job of coordination will be undertaken by the Research Biologists at Grand Canyon National Park. As many independent and unsalaried or uncontracted investigators as possible will be encouraged to work and participate in the investigations. To what extent this latter effort will be successful is unknown at this time.

   Grand Canyon National Park will be called upon to provide support personnel for routine labor activities, such as equipment transportation. Such needs will be minimal. Other than this, there are no other personnel needs anticipated at this time.

10. ADMINISTRATION AND LOGISTICS: Grand Canyon National Park will provide all personal services and support costs unless specified otherwise in contracts with other investigators.

    Grand Canyon National Park will issue the necessary permits to allow for helicopter access to experimental areas that are determined by the Superintendent to be unaccessible by conventional means. Since experimental sites will partially be selected on the basis of their accessibility, this should not be frequently necessary. The Superintendent's approval may occassionally be needed for the establishment of small base camps near experimental areas, when distances from developed areas to experimental sites are great enough to make daily travel between them impractical. Field work will be undertaken during all months of the year. Laboratory and statistical analysis will take place as needed on the South Rim.

FUNDING	YEAR IN PROGRAM SEQUENCE					
	1st	2nd	3rd	4th	5th	6th
Personal Services	$38,500	38,500	38,500	38,500	38,500	38,500
Other than Personal Services	10,500	10,500	10,500	10,500	10,500	10,500
GRAND TOTAL	55,000	55,000	55,000	55,000	55,000	55,000
Funds Available in Park Base	0	0	0	0	0	0
Funds Requested from Regional Office	$55,000	55,000	55,000	55,000	55,000	55,000

On Form	Date Submitted
10-237 / X /	March 1975
10-238 / /	
10-250 / X /	October 1976
10-451 / /	

11. REFERENCES AND CONTACTS:

a. Bennett, Peter S., Research Scientist, Grand Canyon National Park.
b. Johnson, R. Roy, Research Scientist, Grand Canyon National Park.
c. Carothers, Steven, Curator of Biology, Museum of Northern Arizona, Flagstaff, Arizona.
d. Kolipinsky, Milton, Western Regional Office, National Park Service
e. Bibliography of some 600 references is available at Grand Canyon National Park.

12. DATE OF SUBMISSION: March 1975

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park Complex, Western Regional Office.

2. PROJECT NAME AND NUMBER: Desert Bighorn Sheep and Feral Burro Ecology Investigations (GRCA-N-2).

3. STATEMENT OF PROBLEM: This project proposes the study of two interrelated problems. The desert bighorn population in Grand Canyon has decreased and distribution is limited. At the same time, feral burros, introduced into Grand Canyon in 1880's and 1890's, have flourished, increased their populations and distribution, and caused vegetation destruction. The competition between the bighorn and burro needs to be investigated as well as other factors which might limit bighorn population. Information is needed as to where ranges of these animals overlap, and the exact impact on bighorn because of this overlap.

   The role of fencing in managing both bighorn sheep and burro population must be understood before control fences can be installed. The type and dimensions of these fences must be determined.

   Full understanding of the relationship between burros and their environmental impact is not known. Body analysis of burros, and a comparison of vegetation conditions needs to be investigated to evolve a sound tool for monitoring habitat recovery.

4. WHAT HAS BEEN DONE: This project was just barely started by an assigned research biologist when he was promoted and transferred. The study was begun in February 1970. Historical information was compiled, observation records sorted, and selected references reviewed Limited field observations were made and a postcard observation record form was distributed to river runners. After expenditures of about $10,000, the project virtually came to a standstill.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Historical data has been compiled in previous studies. This historical data and all previous work on bighorns and burros must be reviewed. Then, investigations can continue on the population and habitat studies of bighorn and burros. Investigations include field surveys and visual observation surveys, and aircraft flights over the park to determine fencing needs.

Since bighorn and burro management will be a long-term management problem, the information gathered will be quantified to permit a systematic approach and provide a basis for future reexaminations. After information is gathered and evaluated, recommendations will be made for proper management of bighorns in the total Grand Canyon ecosystem. This project should lead to the development of an ecologically and politically sound bighorn management program.

6. LENGTH OF TIME NEEDED: With adequate funding, this project can probably be completed in 4 years. Actual progress in realizing interim goals may dictate the final amount of time needed.

7. WHAT WILL HAPPEN IF PROJECT NOT UNDERTAKEN: We will not have enough knowledge to properly manage adverse impacts that might affect the future existence and welfare of Desert Bighorn at Grand Canyon. Damage to Grand Canyon ecosystem from feral burros will continue because of the lack of effective exclusion fencing.

   A valuable tool for measuring the impact of burros on the environment within the park will be lost. A method of measuring future management program effectiveness will be unavailable. Recovery rates for presently impacted vegetation will not be measured.

8. WHAT ARE THE ALTERNATIVES:

   a. Do nothing and hope the bighorn adapt to any adverse influences and that burros will not damage canyon ecosystem further.

   b. Contract the execution of this project.

   c. Make superficial decisions on bighorn and burro management based on inadequate knowledge.

   d. Attempt to correlate bighorn and burro studies in other desert areas to the burro/bighorn situation at Grand Canyon.

9. WHO WILL ACCOMPLISH PROJECT: This study should be carried out under the supervision of a research biologist assigned to Grand Canyon National Park. Cooperative assistance may be available on an infrequent basis from technical personnel of other agencies interested in bighorn and burros. Laboratory analyses of materials collected during certain phases of the study will be performed by the Museum of Northern Arizona or other contract research agencies.

10. ADMINISTRATION AND LOGISTICS: Much of the equipment needed to accomplish this study is available at the park. The greatest costs will be in connection with transportation and maintenance of field parties.

FUNDING	YEAR IN PROGRAM SEQUENCE			
	1st	2nd	3rd	4th
Personal Services	$49,000	49,000	49,000	49,000
Other Services	21,000	21,000	21,000	21,000
GRAND TOTAL	$70,000	70,000	70,000	70,000
Funds Available From Park Base	0	0	0	0
Funds Requested From Regional Office	$70,000	70,000	70,000	70,000

On Form	Date Submitted
10-237 / X /	January 1976
10-238 / /	
10-250 / /	
10-451 / /	

Buechner, H. K. 1960. "The bighorn sheep in the United States, its past, present, and future." Wildl. Monog., No. 4, The Wildl. Soc. 174 pp. May.

b. Carothers, S. W., M. E. Stitt, and R. R. Johnson. 1975. "Feral Asses on Public Lands. An Analysis of Biotic Impact, Legal Considerations, and Management Alternatives." Paper for 41st North American Wildlife and Natural Resource Conference.

c. Dellenbaugh, F. S. 1887. "The great walled river." Amer. Geog. Soc. Bull. XIX(2):113-163.

d. Guse, N. G. 1973. "Colorado River Bighorn Sheep Survey." Unpubl. MS. 66 pp.

e. Means, E. A. 1907. "Mammals of the Mexican boundary of the United States." Part one, U.S. Nat. Mus. Bull. No. 56. 530 pp.

f. Merriam, C. Hart. 1890. "Results of a biological survey of the San Francisco Mountain Region and desert of the Little Colorado, Arizona." No. Amer. Fauna. No. 3. Govt. Print. Office. 136 pp.

g. Powell, J. W. 1875. "Exploration of the Colorado River of the West and its tributaries, explored in 1869, 1870, 1871, and 1972." Govt. Print. Office. 291 pp.

h. Wright, G. M. and B. H. Thompson. 1934. "Fauna of the National Parks of the United States." Fauna Series No. 2, Natl. Park Serv. Govt. Print. Office. 142 pp. July.

12. DATE OF SUBMISSION: January 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Predator Ecology Study (GRCA-N-3).

3. STATEMENT OF PROBLEM: The status of all major predators in the park is unknown. Predatory mammals are notoriously wide-ranging within their habitats, often covering ten to a hundred square miles. In the course of their daily activities, they often spend part time within the park and part on lands administered by other agencies. Prey species tend to be much less mobile. Therefore, predators may have important ecosystem effects even though they are not confined within the park. Most of the lands surrounding this park are open to stock grazing as well as hunting, and are thus subjected to predator control programs.

4. WHAT HAS BEEN DONE: Few records of large predators exist in park files; little or no research work has been conducted. Arizona Game and Fish has recently conducted preliminary predator studies on adjacent Forest Service lands.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Evolve a contract research program of predator ecology. This includes population status and trends, critical habitat requirements, relationship with prey species and impacts of off-park control measures. This study will identify the importance of predators in park ecosystems, and geographical areas where predators are important and where predators are affected. This will make possible increased understanding of predator roles, recommendations for the management of predator populations, and the knowledge needed to negotiate agreements with other agencies to manage predators partially resident in the park and perpetuate park ecosystems.

6. LENGTH OF TIME NEEDED: 5 years.

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: Without this information, the park will not meet stated responsibilities for maintenance of natural ecosystems. The management policies of adjoining land management agencies will continue to exert major influences on the well-being of the lands within the park.

8. WHAT ARE THE ALTERNATIVES:

   a. Do nothing.
   b. Limit studies to influences only within the park.

9. PERSONNEL: Project to be contracted and conducted by existing park staff.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	-	-	-	-	-
Other than Personal Services	$50,000	50,000	50,000	50,000	50,000
Funds Available in Park Base	0	0	0	0	0
Funds Requested from Regional Office	$50,000	50,000	50,000	50,000	50,000

On Form	Date Submitted
10-237 / X /	October 1976
10-238 / /	(This project will be supported by Increase Nos. 156 and 195.)
10-250 / /	
10-451 / /	

11. REFERENCES AND CONTACTS:

a. Johnson, Roy, Chief, Research Scientist, Grand Canyon National Park.

b. Walters, James E., Resource Management Specialist, Grand Canyon National Park

12. DATE OF SUBMISSION: October 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park Complex, Western Region

2. PROJECT NAME AND NUMBER: Backcountry Carrying Capacity Study, (GRCA-N-4).

3. STATEMENT OF PROBLEM: The impact of visitors in the backcountry areas of Grand Canyon National Park is virtually unknown. Casual observations show marked visual evidence of considerable impact along streams and near springs. The Bright Angel and Kaibab Trails are heavily used by mule riders and day hikers in addition to overnight backpackers. Increasing numbers of visitors are now entering the remotest parts of the canyon. The demand to enter the backcountry is increasing at exponential rates. Scientific data on the impact of visitors on the biota of the backcountry is absolutely necessary to manage visitor use and the natural resources they expect to experience.

4. WHAT HAS BEEN DONE: Nothing has been accomplished in the way of research. Some arbitrary recreation use limitations have been imposed in some of the most heavily visited sites and a reservation/registration system instituted. Plans are underway to increase capacity of facilities at two Inner Canyon sites.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Research is to be undertaken to evaluate and quantify the rate and mode of impact by visitors on the vegetation and soils in selected backcountry areas and sites in Grand Canyon National Park. The major emphasis of the study will be directed toward the determination of changes taking place in the plant communities involved, with only minor attention given to the faunistic changes. The environmental elements of climate, soils, vegetation, and visitor use will receive intensive investigation. Further research will be directed toward finding an efficient, feasible, and rapid method of restoration of damaged areas. Recommendations for future management will be made to minimize impact.

   The goals of this study go beyond simple identification of problems and solutions. The ultimate objective is to obtain information suitable for long-range planning of carrying capacities, desirable physical arrangement of campgrounds, and suitable sites for studying ecological relationships. Such results should find wide use in future master planning and in current operations management.

   Methods: The major elements in the environment will be identified, studied, and where possible, quantified.

Weather records from past years will be examined to determine long-range trends and to evaluate the present climate. These data will be compared to daily weather readings made at official Weather Bureau stations in the park and at nearby locations. Data to be considered will be precipitation, vapor pressure deficits, solar radiation, temperatures, wind movement, and evaporation.

Sites suitable for investigation will be carefully classified according to type and severity of visitor impact. Density independent factors, such as access and location, and density dependent factors, such as soil compaction and human erosion, will be distinguished. These data will be plotted on existing maps of the areas under study. These site quality maps will be used as base maps upon which the data collected under the programs listed below will be entered and ultimately correlated.

Areas will be inventoried for prominent elements of the macro and microflora on randomly selected plots within the study areas. They will have their densities and frequencies determined. These data will be compared with those gathered on randomly selected, undisturbed natural areas nearby. Particular attention will be given to inventorying weed species and making observations about their prominence in the local flora under varying conditions of impact, and later under restoration. The frequency and density of these weed species will be used as an evaluation tool for estimating the degree of damage or restoration achieved. The floral composition will be determined in all four seasons. Voucher specimens will be taken when feasible.

A similar procedure will be used to gather data on the faunal composition of the study areas. Particular attention will be given to insect and rodent populations. Expert opinion will be sought for insect identifications. Voucher specimens will be obtained where possible.

Tree growth will be evaluated both by taking leader length measurements and by the use of a simple dendrometer. Representative trees will be cored by approved methods to determine age and past history of the stands.

These data will lead to comparisons of the impact of density dependent and independent factors on the arboreal vegetation.

The impact of development and visitor impact as a whole will be determined by comparing the vigor of trees within disturbed sites with those found in nearby undisturbed areas.

Soil samples will be taken from sites selected above and will be examined for texture, cation exchange capacity, soluble solids, moisture, temperature, pH, organic content, bulk density, percolation rate, and levels of physiologically important ions. In addition, soil depth will be determined. If feasible, erosion rates will be compared between disturbed and undisturbed sites. Insofar as possible, an evaluation will be made of the micro and macrobiota of the soils. In disturbed areas, restoration of the natural soil ecology will be a major goal in the repair of damaged sites.

Visitor use patterns will be determined by examination of existing park use records, the findings of sociological studies, and by direct observation. No attempt will be made to directly contact visitors; simple observation will be used instead. These data should yield information about the number of man-days used, distribution of use, and the density of stock and foot traffic on the experimental plots.

From this information, determinations of impact per visitor-day can be made, yielding the carrying capacity. Predictions about the number of visitor-days used that will lead to significant deterioration will be determined.

Selected sites under investigation will be closed to public use for a period of time and various schemes for restoration will be tried. These experiments will yield recommendations for the best way(s) of implementing recovery of damaged sites.

6. LENGTH OF TIME NEEDED: With adequate levels of funding, this project can be completed in 4 years.

7. WHAT WILL HAPPEN IF PROJECT NOT UNDERTAKEN: Park Managers will be forced to continue making highly arbitrary decisions based on casual observations of recreation use impact on natural resources. Visitor experience and the resource may seriously degrade.

8. WHAT ARE THE ALTERNATIVES:

   a. Do nothing.

   b. Severely limit recreation use without benefit of concrete rationale.

   c. Permit unlimited recreation use to the point that it is no longer worth the effort to experience the backcountry.

   d. Exclude all public use from backcountry because of impact on natural ecosystems.

   e. Provide sufficient public use facilities to mitigate all long-term impacts.

9. WHO WILL ACCOMPLISH PROJECT: The bulk of this project will be directed and accomplished by research personnel assigned to the park. It will be possible to contract up to 50 percent of the execution of the research.

10. ADMINISTRATION AND LOGISTICS: Most of the equipment and material is already on hand in the Grand Canyon Ecological Studies Laboratory.

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	-	-	-	-	-
Other than Personal Services	-	-	50,000	50,000	50,000
GRAND TOTAL	-	-	50,000	50,000	50,000
Funds Available in Park Base	-	-	0	0	0
Funds Requested From Regional Office	-	-	50,000	50,000	50,000

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10-237 / X /	October 1976
10-238 / /	
10-250 / /	
10-451 / /	

11. REFERENCES AND CONTACTS

a. Johnson, R. Roy, Senior Research Scientist, Grand Canyon National Park.

b. Bennett, Peter S., Research Scientist, Grand Canyon National Park.

c. Harvey, H. T., Hartesveldt, R. J., Stanley, J. T. 1972. Wilderness Impact Study Report. Sierra Club Outing Committee, San Francisco, California 87 pp.

d. Brickler, Stanley K., Department of Watershed Management, University of Arizona, Tucson, Arizona.

12. DATE OF SUBMISSION: December 1976.

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Kaibab Squirrel Ecology Study (GRCA-N-5).

3. STATEMENT OF PROBLEM: The Kaibab squirrel, Sciurus kaibabensis, is found only in a restricted area of the ponderosa pine forest of the Kaibab plateau in northern Arizona. The squirrel is well known because of its recognized attractiveness and fame as an example of a species that developed as a result of isolation due to the creation of the Grand Canyon. A population trend study conducted since 1963 by Dr. Joseph Hall, California State University, San Francisco, indicates that the squirrel population is steadily declining and is now at its lowest level since the study began. Dr. Hall has stated that he believes that the Kaibab squirrel population of the North Rim Unit of Grand Canyon for 1974 is less than 100 animals for the estimated 20,000 acres of ponderosa pine on the rim.

4. WHAT HAS BEEN DONE: An interagency committee was formed to pool research information on this squirrel and similar species being studied. This committee is still active, meeting once a year.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: A study of the squirrel and its natural history needs to be made to determine the causes for the population decline, and if possible take steps to prevent it from becoming extinct in the park.

6. LENGTH OF TIME NEEDED: 3 years.

7. WHAT WILL HAPPEN IF PROJECT IS NOT UNDERTAKEN:

   a. If the decline continues, the squirrel may become extinct in the park.

   b. The squirrel population may make a comeback or remain static.

8. WHAT ARE THE ALTERNATIVES:

   a. Continue to monitor the population and rely on related studies in other areas to furnish clues to the reasons for the decline.

   b. Do nothing and hope that whatever is causing the decline will change.

9. WHO WILL ACCOMPLISH PROJECT: Project should be contracted out to a University. If Dr. Hall had adequate funding, he would be the person most likely to contact regarding such a study.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	-	-	-	-	-
Other than Personal Services	-	-	$6,000	6,000	6,000
Funds Available in Park Base	-	-	0	-	-
Funds Requested from Regional Office	-	-	$6,000	6,000	6,000

On Form		Date Submitted
10-237	/ X /	October 1976
10-238	/ /	(This program will also be supported by Increase Nos. 195 and 156.)
10-250	/ /	
10-451	/ /	

11. REFERENCES AND CONTACTS

a. Hall, Joseph G., "The Kaibab Squirrel in Grand Canyon National Park," A seven seasons summary. 1960-66, M.S.

b. Goldman, E. A., "The Kaibab or White-tailed Squirrel," Journal of Mammalogy, Vol. 9., 1928.

c. Hall, Joseph G., "White Tails and Yellow Pines," (Kaibab Squirrel and Ponderosa pine), National Parks, Vol. 41, No. 325, April 1967, p. 9-11.

d. Walters, James E., Resource Management Specialist, Grand Canyon.

12. DATE OF SUBMISSION: October 1976

11. REFERENCES AND CONTACTS

a. Hall, Joseph G., "The Kaibab Squirrel in Grand Canyon National Park," A seven seasons summary. 1960-66, M.S.

b. Goldman, E. A., "The Kaibab or White-tailed Squirrel," Journal of Mammalogy, Vol. 9., 1928.

c. Hall, Joseph G., "White Tails and Yellow Pines," (Kaibab Squirrel and Ponderosa pine), National Parks, Vol. 41, No. 325, April 1967, p. 9-11.

d. Walters, James E., Resource Management Specialist, Grand Canyon.

12. DATE OF SUBMISSION: October 1976

NATURAL RESOURCE PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Meadow Restoration and Ecology Study (GRCA-N-6).

3. STATEMENT OF PROBLEM: The North Rim contains approximately 90 miles of backcountry roads, 15 miles of which are in meadowland. The roads are a scar crossing many miles of scenic grassland and forest land. Most of these roads follow the bottoms of drainages, causing soil erosion and affecting surface drainage. In places, heavy compaction of soils from vehicle traffic has occurred, resulting in road levels in places being a foot or more below the surrounding ground level. Meadowland is particularly affected by fire roads because the soils are easily eroded and the changes in the meadow drainage patterns have great effects on the meadows. Little research has been done on meadow ecology and very little information is available on the effects of the roads on the meadows. Although the meadows make up a small percentage of the North Rim acreage, they contribute greatly to the overall scenic beauty of the area and enhance the park visitors' trip. They also constitute an important ecological biome containing a wide variety of grasses, wildflowers, and animals.

4. WHAT HAS BEEN DONE: Grand Canyon research proposal "An Ecological Investigation of North Rim Meadows" has been submitted for the purposes of gaining a greater understanding of the forces that affect meadows. One road which crossed meadowland has been closed and more road closures are planned.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Contract ecology study to a research institution. Immediately close all non-essential roads and scarify and re-seed. Reroute essential roads to minimize impact on meadows. Carry out an immediate management program based on preserving the meadows from direct impacts (roads). Research will reveal methods of protection from subtle impacts.

6. LENGTH OF TIME NEEDED: 3 years for meadow study, three summer seasons for road and meadow rehabilitation.

7. WHAT WILL HAPPEN IF PROJECT IS NOT UNDERTAKEN:

   a. The roads will remain a blight on the forest and meadow landscape.

   b. Erosion will increase, damaging the meadows and forest land.

   c. Compacted soil and road ruts will change meadow drainage patterns, which in turn will bring about changes in the meadow ecology.

8. WHAT ARE THE ALTERNATIVES:

   a. Close roads where practicable and rehabilitate as much as possible with available manpower and funds.

   b. Reroute roads and carry out meadow restoration and road rehabilitation when more funds are available.

9. WHO WILL ACCOMPLISH PROJECT: North Rim staffing and contract researchers.

10. ADMINISTRATION AND LOGISTICS OF THE PROJECT: Equipment used by Roads and Trails maintenance crew may be used to do some of rehabilitation work.

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
For Study	-	-	7,000	7,000	7,000
For Rehabilitation	-	-	8,000	8,000	8,000
GRAND TOTAL	-	-	15,000	15,000	15,000
Available in Park Base	-	-	0	0	0
Funds Requested from Regional Office	-	-	15,000	15,000	15,000

Funds requested on Form 10-237 October 1976

11. REFERENCE AND CONTACTS:

   a. Merkle, John, "Plant Communities of the Grand Canyon Area" Ecology, Vol. 43, No. 4, Autumn 1962 P. 698-711.

   b. Merkle, John, "An Ecological Analysis of the Meadows on the Kaibab Plateau," Arizona Yearbook, Amer. Philsophical Society, 1953, P. 157-160.

   c. Sleznich, James Jr. "Orchids of Grand Canyon National Park." American Orchid Society, May 1961, P. 360-362.

   d. Rasmussen, D.I., "Biotic Communities of Kaibab Plateau," 1941, Plateau, Arizona Ecological Monograph 11(3):229-275.

12. DATE OF SUBMISSION: October 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park Complex, Western Regional Office

2. PROJECT NAME AND NUMBER: Study of Visitor Impact on Mather Campground Biota (GRCA-N-7).

3. STATEMENT OF PROBLEM: Mather Campground in Grand Canyon Village is heavily used by visitors throughout the year. The resulting impact on vegetation is great. Research is needed to determine practical means for maintaining a semblence of natural conditions in the campground. Vegetation does not rejuvenate naturally for many years under arid conditions.

4. WHAT HAS BEEN DONE: Data has been gathered on visitor use at Mather Campground. In addition, use information has been gathered on types and uses of camping equipment, what sites are favored by people with particular kinds of equipment, whether they camp with children, and whether they cook out-of-doors. The types and intensity of use have been correlated with ecosystems, and the effects compared to nearby "natural" control areas. Four representative sites have been mapped in great detail, and gross changes noted since the study began. Data has been gathered about tree growth by the use of tree rings. A large number of soil samples have been analyzed for physical, chemical, and microbiological parameters. Populations of vertebrates have been determined for comparison with the control plots.

5. DESCRIPTION OF THE WORK TO BE UNDERTAKEN: Description: Research is to be undertaken to evaluate and quantify the rate and mode of impact by visitors on the vegetation and soils of Grand Canyon National Park. The major emphasis of the study will be directed toward the determination of changes taking place, the plant communities involved with only minor attention given to the faunistic changes. The environmental elements of climate, soils, vegetation, and visitor use will receive intensive investigation. Further research will be directed toward finding an efficient, feasible, and rapid method of restoration of damaged areas. Recommendations for future management will be made to minimize impact.

   The goals of this study go beyond simple identification of problems and solutions. The ultimate objective is to obtain information suitable for long-range planning; seeking to provide data about carrying capacities, desirable physical arrangement of campgrounds, and suitable sites for development from an ecological point of view. Such results should find wide use in future planning.

Methods: The major elements in the environment will be identified, studied, and where possible, quantified.

Weather records from past years will be examined to determine long-range trends and to evaluate the present climate. This data will be compared to daily weather readings made at official Weather Bureau stations in the park and at nearby locations. The data collected during the duration of the study will be used as an experimental control to correct findings for the effects of short-term weather fluctuations. Data to be considered will be precipitation, vapor pressure deficits, solar radiation, temperatures, wind movement, and evaporation.

Sites suitable for investigation will be carefully classified according to type and severity of visitor impact. Density independent factors, such as pavement area and location, and density dependent factors, such as soil compaction and human erosion, will be distinguished. This data will be plotted on existing maps of the areas under study. These site quality maps will be used as base maps upon which the data collected under the programs listed below will be entered and ultimately correlated.

Areas will be inventoried for prominent elements of the macro and microflora on randomly selected plots within the study areas. They will have their densities and frequencies determined. This data will be compared with that gathered on randomly selected, undisturbed natural areas nearby. Particular attention will be given toward inventorying weed species and making observations about their prominence in the local flora under varying conditions of impact, and later under restoration. The frequency and density of these weed species will be used as an evaluation tool for estimating the degree of damage or restoration achieved. The floral composition will be determined in all four seasons. Voucher specimens will be taken when feasible.

A similar procedure will be used to gather data on the faunal composition of the study areas. Particular attention will be given to insect and rodent populations. Expert opinion will be sought for insect identifications. Voucher specimens will be obtained where possible.

Tree growth will be evaluated both by taking leader length measurements and by the use of a simple dendrometer. Representative trees will be cored by approved methods to determine age and past history of the stands.

This data will lead to comparisons of the impact of density dependent and independent factors on the arboreal vegetation.

The impact of development and visitor impact as a whole will be determined by comparing the vigor of trees within disturbed sites with those found in nearby undisturbed areas.

Soil samples will be taken from sites selected above, and will be examined for texture, cation exchange capacity, soluble solids, moisture, temperature, pH, organic content, bulk density, percolation rate, and levels of physiologically important ions. In addition, soil depth will be determined. If feasible, erosion rates will be compared between disturbed and undisturbed sites. Insofar as possible, an evaluation will be made of the micro and macrobiota of the soils. In disturbed areas, restoration of the natural soil ecology will be a major goal in the repair of damaged sites.

Visitor use patterns will be determined by examination of existing park use records, and by direct observation. No attempt will be made to directly contact visitors; simple observation will be used instead. This data should yield information about the number of visitor-days used, distribution of use, and density of vehicle and foot traffic on the experimental plots.

From this information, determinations of impact per visitor-day can be made, yielding the carrying capacity. Predictions about the number of visitor-days used that will lead to significant deterioration will be determined.

Selected sites under investigation will be closed to public use for a period of time and various schemes for restoration will be tried. These experiments will yield recommendations for the best way(s) of implementing recovery of damaged sites.

6. LENGTH OF TIME NEEDED: This project can be completed by 1978 with adequate funding.

7. WHAT WILL HAPPEN IF PROJECT NOT UNDERTAKEN: Mather Campground will likely continue to deteriorate and become aesthetically unpleasant and biologically depleted. Attempts to restore a semblance of natural conditions may be uneconomical and ineffective without a proper data base.

8. WHAT ARE THE ALTERNATIVES:

a. Move the campground when the present one is severely depleted.

b. Close portions of the campground in rotation for several year's duration.

c. Attempt reseeding and revegetation by trial and error methods.

d. Severely reduce the number of times a camping site can be used during the travel season.

9. WHO WILL ACCOMPLISH PROJECT: The bulk of this research project will be carried out by the Research Scientist assigned to the park. As additional labor is available from the park, it will be used from time to time.

10. ADMINISTRATION AND LOGISTICS OF THE PROJECT: The administration and support for this project is handled through the Grand Canyon Ecological Studies Laboratory.

FUNDING	YEAR IN PROGRAM SEQUENCE:				
	1st	2nd	3rd	4th	5th
Personal Services	-	-	-	-	-
Other than Personal Services			7,000	7,000	7,000
GRAND TOTAL					
Funds Available in Park Base	-	-	0	0	0
Funds Requested from Regional Office	-	-	7,000	7,000	7,000

On Form		Date Submitted
10-237	/ X /	October 1976
10-238	/ /	(Program to be supported by Increase
10-250	/ /	No. 156.)
10-451	/ /	

11. REFERENCES AND CONTACTS

a. Harvey, H. T., Hartesveldt, R. J., Stanley, J. T. 1972. Wilderness Impact Study Report. Sierra Club Outing Committee, San Francisco, California 87 pp.

b. Bennett, Peter S. Research Scientist, Grand Canyon National Park.

12. DATE OF SUBMISSION: December 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Monitor Deer Population Trends (GRCA-N-8).

3. STATEMENT OF PROBLEM: The present status and population trends for the park's deer herds are unknown; impacts of deer on the park are also unmonitored. The park continues to depend on outside agencies for information on its herds. Also, hunting and predator control efforts on lands adjoining the park have an unknown effect on park animals. A basic understanding of herd parameters is needed before proper management can be instigated.

4. WHAT HAS BEEN DONE: Park browse and pellet group transects were established and read up until 1966. Arizona Game and Fish continues to operate transects on adjacent lands and within the park (through a cooperative agreement). These transects were relocated and cleared during the summer of 1977 by park volunteers.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Reinstitute deer monitoring program through range and pellet group transects and a tagging program. The objective of this program will be the establishment of park deer populations data.

6. LENGTH OF TIME NEEDED: On-going (5 years).

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: The park will continue its dependence on outside agencies to regulate its deer herds. The park will also continue to absorb whatever impacts hunting, and predator control measures on adjacent lands has on its own herds. Whatever damage is presently occurring because of possible excess numbers of animals will continue.

8. WHAT ARE THE ALTERNATIVES:

   a. Do nothing and continue to depend on outside agencies for resource management data.

   b. Restrict surveys only to areas receiving impact from hunting and predator control pressures.

9. PERSONNEL: Existing park staff.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	(To be executed within existing budget and as funds become available.)				
Other than Personal Services	$1,500	1,500	1,500	1,500	1,500
Funds Available in Park Base	1,500	1,500	1,500	1,500	1,500
Funds Requested from Regional Office	0	0	0	0	0

On Form	Date Submitted
10-237 / X /	October 1976
10-238 / /	(To be executed within existing programs with support from Increase Nos. 152 and 195.)
10-250 / /	
10-451 / /	

11. REFERENCES AND CONTACTS:

a. Walters, James E., Resource Management Specialist, Grand Canyon National Park.

12. DATE OF SUBMISSION: December 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Environmental Effects of Stock Use in the Inner Canyon, (GRCA-N-9).

3. STATEMENT OF THE PROBLEM: The park currently maintains a horse and mule population of nearly 200 animals. The impact of these large animals on the park needs to be analyzed and methods of management adopted to minimize the damage. Obvious impacts include: trail widening; grazing; waste problems; trail and water contamination; exotic species introduction; and conflicts with hikers. These problems involve both National Park Service and concession animals.

4. WHAT HAS BEEN DONE: No records of previous investigations into this problem exist in division files.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Monitor adverse impacts of stock use to determine extent and rate. Evolve methods, in cooperation with National Park Service and concession stock personnel, of minimizing impacts of present levels of stock use.

6. LENGTH OF TIME NEEDED: 1 year.

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: The present impacts on the park's ecosystem will continue at their current rate. The Indian Gardens and Plateau Point area will continue to experience the effects of erosion and trail widening. The park will maintain conditions conducive to exotic species and will neglect responsibilities towards minimizing this impact on the park environment.

8. WHAT ARE THE ALTERNATIVES:

   a. Do nothing.
   b. Eliminate stock from the park.
   c. Reduce current levels of stock use.
   d. Closely regulate current stock use.

9. PERSONNEL: To be conducted by existing park staff.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	$250				
Other than Personal Services	250				
Funds Available in Park Base	500				
Funds Requested from Regional Office	0				

On Form		Date Submitted
10-237	/ X /	October 1976
10-238	/ /	(Program to be conducted by exist-
10-250	/ /	ing staff with support from Increase
10-451	/ /	Nos. 156 and 195.)

11. REFERENCES AND CONTACTS:

a. Walters, James E., Resource Management Specialist, Grand Canyon National Park.

12. DATE OF SUBMISSION: January 1977

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: South Rim Small Mammal Survey (GRCA-N-10).

3. STATEMENT OF PROBLEM: The influence of development, increased visitation, feral dogs and cats, and artificial feeding has a currently unknown effect on small mammals within Grand Canyon Village. Information is needed to effect a resource management program.

4. WHAT HAS BEEN DONE: Little or no information of mammal populations within the village exists in present park files.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Conduct a small mammal census program using accepted techniques of trapping, tagging and site records. Whatever practical and needed to gather basic population data will be used.

6. LENGTH OF TIME NEEDED: Continuing, 5 years.

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: The impact of Grand Canyon Village will continue on small mammals (a decline is suspected). Management measures will not be available due to a lack of information.

8. WHAT ARE THE ALTERNATIVES:
   a. Do nothing.

9. PERSONNEL: Existing personnel.

10. ADMINISTRATION AND LOGISTICS

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	(To be conducted with existing funds.)				
Other than Personal Service	$200	200	200	200	200
Funds Available in Park Base	200	200	200	200	200
Funds Requested from Reg. Ofc	0	0	0	0	0

On Form		Date Submitted
10-237	/ X /	October 1976
10-238	/ /	(To be conducted within existing program with support from Increase No. 156.
10-451	/ /	

11. REFERENCE AND CONTACTS

   a. Walters, James E., Resource Mgt. Specialist, Grand Canyon Natl Park.

12. DATE OF SUBMISSION: December 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Feasibility Study for Reintroduction of the the Southwestern River Otter (GRCA-N-11)

3. STATEMENT OF PROBLEM: The Southwestern River Otter (Lutra canadensis sonora) is possibly extinct within the park. At any rate, its population is extremely low and nowhere near the approximate numbers observed in historical times. A study is needed to determine the feasibility of reintroducing this animal into the park section of the Colorado River.

4. WHAT HAS BEEN DONE: A preliminary proposal has been submitted by a Research Biologist of the Museum of Northern Arizona. This proposal outlines the activities and time schedules that need to be undertaken to place this project into effect.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Conduct a literature search to compile all available information. Investigate otter breeding programs throughout the U. S. Initiate a correspondence program with other wildlife managing agencies to determine feasibility of our proposal. Evaluate the possibility of a breeding program if capture and release program proves infeasible. Conduct the reintroduction operation.

6. LENGTH OF TIME NEEDED: 7 years

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: The park will, in all probability, lose this native wildlife species and fail to follow the edicts of management addressing wildlife resources.

8. ALTERNATIVES:

   a. Do nothing
   b. Attempt a transplanting program without background research.

9. PERSONNEL: Work will be contracted to a single individual at the Museum of Northern Arizona.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	$1000	(The remainder of the fiscal program			
Other than Personal Services	-	will be determined by the findings of the literature survey.)			
Funds Available in Park Base	-	-	-	-	-
Funds Requested From Regional Office	$1000				

11. REFERENCES AND CONTACTS

a. Stevens, Lawrence E., Research Biologist, Museum of Northern Arizona

b. Walters, James E., Resource Management Specialist, Grand Canyon National Park

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Identification of Endangered Plants Habitat (GRCA-N-12).

3. STATEMENT OF PROBLEM: Beyond knowledge of their existance, little is known about the 25 plant species identified as "Endangered or Threatened." This lack of information also includes the identification of critical habitat necessary for the survival of these species. Without this basic information, the park stands in danger of losing these plant species.

4. WHAT HAS BEEN DONE: Nothing.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Gather habitat information through the R.B.I. and independent studies, and instigate appropriate management action to insure the survival of these plant species. Management may include: elimination or instigation of controlled burning, water development, and area closures. All information will be integrated into the R.B.I.

6. LENGTH OF TIME NEEDED: 5 years.

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: The park will continue in its present inability to manage these plants. Populations will continue to receive adverse impacts and diminish.

8. WHAT ARE THE ALTERNATIVES:

   a. Do nothing.

9. PERSONNEL: R.B.I. contracts and existing park staff.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	-	-	-	-	-
Other than Personal Services	$500	500	500	500	500
Funds Available in Park Base	0	0	0	0	0
Funds Requested from Regional Office	$500	500	500	500	500

On Form	Date Submitted
10-237 / X /	March 1976
10-238 / /	(Also included in Increase Nos. 162 and 137.)
10-250 / /	
10-451 / /	

11. REFERENCES AND CONTACTS

a. Bennett, Peter S., Research Scientist, Grand Canyon National Park.
b. Johnson, R. Roy, Research Scientist, Grand Canyon National Park.
c. Carothers, Steven, Curator of Biology, Museum of Northern Arizona, Flagstaff, Arizona.
d. Kolipinsky, Milton, Western Region Office, National Park Service.
e. Bibliography of some 600 references is available at Grand Canyon National Park.
f. Walters, James E., Resource Management Specialist, Grand Canyon National Park.

12. DATE OF SUBMISSION: March 1976.

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: The Feral Burro Management Plan (GRCA-RM-1) and the Colorado River Management Plan (GRCA-RM-2) have been deemed significantly controversial to require full Environmental Impact Statements. These documents will be finalized in Fiscal Year 1979 and Fiscal Year 1978, respectively. Since these documents are in the process of development and must undergo the complete legal processes as described by the National Environmental Policy Act of 1969, there is no need to describe them here.

3. ADMINISTRATION AND LOGISTICS SUPPORTING EIS DEVELOPMENT:

FUNDING		YEAR IN PROGRAM SEQUENCE	
		FY 78	FY 79
Personal Services	Burro	3,600	3,000
	River	5,000	
Other than NPS	Burro	26,400	2,000
	River	10,000	
Funds Available in Park Base	Burro	0	0
	River	0	
Funds Requested from Regional Office	Burro	30,000	5,000
	River	15,000	

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Fire Management Plan (GRCA RM-3)

3. STATEMENT OF PROBLEM: The practice of fire suppression for the last 70 years, in what is today Grand Canyon National Park, has resulted in adverse changes in the natural environment.

   Fire suppression activities account for the extinguishment of 40 to 45 naturally caused fires per year on the 1,218,375 acres of park land. This exclusion of fire from the natural ecosystem has resulted in major changes in the environment. The natural mosaic of vegetation types and age classes is being altered. Spruce and fir are invading the open stands of ponderosa pine, crowding out the fire dependent ponderosa and replacing it with a more fire susceptible forest. Fire is needed for ponderosa pine seed germination, and to thin out the thick stands of young seedlings for optimum growing conditions. Among the ponderosa and spruce-fir forests, woody fuel accumulations have reached abnormally high levels, choking out many of the small ground plants and also increasing the potential for the occurrence of major fires.

4. WHAT HAS BEEN DONE: Money was appropriated and a 5-year research project was initiated to study fire ecology on the North Rim of Grand Canyon in 1970. The objectives of the project were to gather information, evaluate the effects of fire on the forest environment and to develop an understanding of prescribed burning in the ponderosa and spruce-fir forests. As part of this research project a total of 100 acres have been burned in several experimental burns and the results evaluated. The study was completed in 1975. This work now provides the basis for prescription burning in a ponderosa forest. However, management decisions must be made as to the objectives of prescribed burning, in terms of individual forest inventories.

   A study of the park's fire history based on information collected from the Fire Atlas, which furnishes data on fires since 1932, and a review of individual fire reports, was made in 1972. Special emphasis of the study was placed on fire locations, time of occurrence, acreage burned, and type of vegetation where fire occurred.

   An inventory of woody fuels for the ponderosa pine forests began in 1974 and is continuing. A fuel map for the forests of Grand Canyon should be completed by the end of 1977.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: The goal of this fire management plan is to reduce high fuel concentrations and to gradually restore natural fire in order to reestablish the natural environment as it existed before man's manipulation through fire suppression. An additional goal will be to work toward preserving this environment for the enjoyment of future generations in accordance with National Park Service Fire Management policy.

To accomplish this goal, the following plan will be used as a basis for the entire fire management program:

a. The park has been divided into appropriate fire zones based upon laws, management policies and park goals. These zones are described later in this project statement.

b. In all areas calling for prescription burning, a survey or forest inventory, as described in Bennett's (1976) report, will be made. Much of this work is to be accomplished under the Ecological Information Base Project (GRCA-N-1) scheduled for FY'77.

c. A management decision will be made as to what the forest should look like. This objective, in terms of forest composition and fuel loads, will be used to determine exactly what each burn is expected to achieve.

d. Utilizing these decisions and the data generated by Bennett's (1976) research project, individual forest plots will be analyzed as to exact prescriptions needed to obtain stated objectives. This procedure does necessitate that proper statistical evaluation of field conditions be made prior to any burning operation.

This plan also recognizes the utilization of the techniques described by Bennett (1976) as the basic method of operating a prescribed burning program at Grand Canyon National Park. These factors may be converted to the National Fire Danger Rating System when needed for communication with cooperating agencies and where insufficient data exists for the proper implementation of Bennett's system. This system involves the translation of field data into a computer program. Based on management decisions as to what the forest should look like, the computer then develops prescriptions needed to achieve these objectives.

I. MANAGEMENT FIRES - GENERAL

Management fires, including both fires of natural origin and prescribed burns, are those which contribute to the attainment of the management objectives of a park through execution of predetermined prescriptions.

Natural fire is the preferred means to achieve the prescriptions in natural zones. This use of natural ignition may be adopted when analysis of historic fire occurrence, control and influences indicates that natural fuel loading has not been significantly altered by past management or fire control. It may also be used where the prescription provides for a transition from an altered state back to historic fuel loading.

In ecosystems modified by prolonged exclusion of fire, prescribed burning may be used to reduce fuel loading to natural levels, or to reduce fuels along boundaries of management zones thereby reducing the probability of wildfires crossing into or out of a zone.

Prescribed burning may be used as a substitute for natural fire in the prescription for natural zones where it is determined that natural fire cannot meet the objectives. In natural zones, the objective for prescribed burning is to simulate, to the fullest extent, the influence of natural fire on the ecosystem. In other zones it may be used to recreate or perpetuate a historic setting or to attain other resource management objectives.

Clearly defined limits will be established in the prescription of all management fires, beyond which, limited or complete control action will be undertaken. These limits will be based upon information derived from the forest inventory, and resultant computer programs.

Management fires in the park will be suppressed when threatening

- human life;
- cultural resources or physical facilities of the park;
- threatened or endangered species;
- to escape from predetermined zones or from the park, except where cooperative agreements provide for certain fires to cross such boundaries; or
- to exceed the prescription.

PARK FIRE ORGANIZATION AND RESPONSIBILITIES (McLaren 1977)

(1) Superintendent:

A. As administrative officer, is in charge of entire park organization.
B. Is responsible for all phases of fire management.
C. May delegate authority to Fire Management committee and Fire Management Officer for all fire management activities within the park.
D. Makes final review and rejects or approves: prescribe burning plans; fire management plans; goals; policy.

(2) Fire Management Committee:

A. Membership:
   1. Chief Park Ranger.
   2. Chief of Resource Management.
   3. Resource Management Specialist.
   4. Supervisor, Kaibab National Forest (or his representative).

B. Temporary committee members.
   1. Unit Managers concerned with the business before the committee.
   2. Unit Resource Managers whose units are affected by the business before the committee.
   3. Members of other agencies when committee business concerns them.
   4. Research scientist.

C. Responsibilities of the Committee:

   1. Submits to the superintendent for approval annual prescribed burning plans after they have been reviewed and approved by the committee.

   2. Makes recommendations to the superintendent, through documented reports on fire management policy, goals and resource management objectives for the park.

   3. Reviews annually the fire management plan and makes changes where needed.

   4. Recommends to the Superintendent a Fire Management Officer.

(3) In addition to those responsibilities listed above, the following apply:

A. Fire Management Officer:

1. Is responsible for making decisions, based on prescription burn criteria and circumstances, whether to allow a naturally caused fire to burn or to be suppressed.

2. One or more of these officers may be recommended by the fire committee.

3. Must have Red Card qualifications as Fire Boss II, Plans Chief II or better.

4. Fire Management Officer or similarly qualified person designated as acting Fire Management Officer must be present in the park at all times when a management fire is burning or when a prescribed burn is taking place.

5. Appoints a prescribe burn boss to carry out prescribed burning plans.

6. Works in conjunction with Unit Managers or District Rangers of area involved in carrying out prescribed burning or in allowing management fires to burn.

B. Unit Manager or District Ranger:

1. Makes recommendations to fire management committee concerning area of responsibility.

2. Is responsible for monitoring of management fires.

3. Is responsible for suppression of all wildfires within unit or district.

4. Insures that all preliminary activities involved in prescribed burning and fire management are carried out.

C. Unit Resource Manager:

1. Works under delegated authority from unit manager.

2. Supervises Fire Management crew.

3. Is responsible to Unit Manager for:

   a. Proper monitoring of management fires.

   b. Maintaining careful check on weather forecasts and burning conditions to insure that fire remains in prescription.

c. Submitting prescribed burning plans and recommendations to Unit Manager.

d. Carrying- out fuel inventories and collecting fire weather data.

e. Suppressing all wildfires.

f. Putting in control lines and arranging for manpower and equipment for prescribed burns.

D. Prescribed Burn Boss:

1. Works in conjunction with Unit Resource Manager.

2. Directs burning sequences.

3. Acts as Fire Boss on prescribe burn.

4. Is responsible for all personnel and equipment under his/her supervision.

5. Insures that the fire lines are sufficiently patrolled and remains within burn unit boundaries.

6. Monitors burn prescription and keeps fire management officer and unit manager informed of fire behavior.

7. Is appointed for each major burn.

8. Compiles cost data summary sheets and fire reports.

9. Initiation of Limited or Complete Control Action: The Burn Boss may initiate limited or complete control action in an emergency if any fire threatens human life, cultural resources or physical facilities, threatened or endangered species; or threatens to escape from predetermined boundaries or from the park, except where cooperative agreements provide for such contingencies; or to burn under extreme fire weather conditions. Spot fires are an exception, and while they should be immediately extinguished, they are not cause for immediate suppression of a burn.

E. Research Scientist (Biologist):

1. Acts as an advisor for prescribed burning program.

2. Is responsible for all research relating to Fire Management Program.

F. Chief of Park Interpretation and Unit Interpreter:

1. Provides interpretive services and literature to inform the public concerning on-going fire management activities and the rationale for them.

G. Park Anthropologist:

1. Acts as an advisor to Fire Management Officer concerning possible damage to cultural resources in the vicinity of a management fire.

2. Advises committee that management fires are conducted in compliance with E.O. 11593.

3. Reviews prescriptions as to locality and its relation to historic and cultural resources.

4. Determines if field surveys are needed prior to burning operations.

5. Recommends the need to modify the field program or make special provisions to protect specific sites.

H. Public Relations Officer:

1. Prints news release and deals with all forms of the news media concerning information on current management activities.

II. PRESCRIPTION FIRES

To accomplish management goals the natural roles of fire will be restored to all ecosystems. Kilgore (1972) lists these roles: Seedbed preparation; recycling of nutrients; setting back plant succession; providing conditions favorable for wildlife; providing a mosaic of age classes and vegetation types; reduction of numbers of trees susceptible to attack by insects and diseases; reduction of fire hazards.

To restore the natural role of fire to the environment various fire management techniques will be employed.

Prescribed Burning

Prescribed burning is the skillful application of fire to natural fuels within a defined set of weather conditions, fuel moisture, and other influencing factors, that allows confinement of the fire within control lines.

A primary objective of prescribed fire is to reduce high fuel concentrations in areas where past fire suppression activities have altered the forest environment to the point where management fires cannot be allowed to burn uncontrolled. Burning for this purpose will be carried out as a preliminary step in the transition from total fire suppression to natural prescribed fires in the ponderosa and spruce-fir forests. The only areas of these forests where prescribed fire will be used are those where abnormal fuel loadings occur or where pure ponderosa pine stands have been invaded by spruce and fir, creating situations for more intense fires than would normally occur in nature.

Another use of prescribed fire will be to create fuel breaks along park boundaries where needed, to help prevent management fires from burning beyond management or agency boundaries. These fuel breaks would be needed along the north park boundary extending from Fire Point to Saddle Mountain. On the South Rim fuel breaks would be needed along those stretches of boundary where ponderosa forest exists.

Prescribed fire will be used in areas where developments, cultural resources or high visitor use preclude the use of any natural prescribed fires:

1. Certain areas on or near Bright Angel Point on the North Rim need to be prescription burned to reduce fuel loadings and restore the natural forest environment. Prescribed burning on a limited scale to reach these objectives could be carried out in the late fall months after the North Rim has been closed to visitation. Burning blocks would be kept to relatively small size in the 5 to 20 acre category to minimize visual impact and yet meet management objectives.

2. The ponderosa forest in the Buggeln Hill area on the South Rim lies close to the park boundary and high visitor use areas. Here the use of prescribed burning in early winter months, when visitor use is low, will be carried out to reduce fuels and thin the numerous large dog hair thickets of young ponderosa pine seedlings which have grown up as the result of past fire suppression activities.

3. High visitor use areas at Point Imperial on the North Rim and Grandview on the South Rim may be treated by prescribed fire in the early winter months when visitation is low and prescribed burning conditions ideal.

4. Prescribed burning may be used as a tool to retard or eliminate some types of tree diseases and insect infestations.

The exact burning prescriptions used in this management program will be established in keeping with park management policies, fire management zones, conducted park research data, and standard fire management techniques and safeguards. Consideration will be given to adjoining land managing agencies and their respective edicts and policies. These prescriptions will be based upon vegetation data, including forest inventories, and a management determination of specific objectives to be achieved. These objectives will be expressed in terms of specific fuel loads, species dispersion, age classes and other measurable factors. Prescriptions will be keyed to specific vegetative tracts and, along with overall policies, will form the basis for management decisions as to response to fire. This will include management zones identified as natural fire zones.

Prescribed Burning Procedures

Proposed annual burn plans specifying areas to be burned, management objectives, fuel conditions, and including maps and other pertinent data, will be submitted each year by the Unit Manager or District

anger to the fire management committee for review and preliminary approval. If approved by the Fire Management Committee, plans will then be sent to the Superintendent for final approval.

The Unit Manager or District Ranger is responsible for making all preparations needed for carrying out prescribed burns in his/her area. These preparations will include:

1. Monitoring fuel moisture at the site, starting at least one week prior to proposed burning date.

2. Putting in control lines or applying retardents where they are deemed practical.

3. Protecting all power lines, utilities, structures and roads within or adjacent to the burn area.

4. Monitoring weather conditions, and following burn prescription.

5. Insuring that needed manpower and equipment for burn is available and organized.

6. Keeping all persons concerned with burn informed as to burn prescription conditions at site and any other pertinent information.

Burning blocks, depending on management objectives, may vary from 5 to 500 acres in size. Control lines around burning blocks will be made by the use of hand tools to minimize impact on the environment; after the burn is out all control lines and other impacts will be eliminated as much as possible. The use of chemical retardants will be used as practicable to minimize impact.

The burning techniques used will be chosen to meet management objectives and simulate natural fire conditions as much as possible.

Backing-fires or strip fires are best used on dry slopes. Headfire may be used on moist, north facing slopes. The use of backfire to establish blacklines or fuel breaks along perimeters of burn may be used when needed, to insure protection of fire lines.

Site must be within the limits of the burn prescription before the burn will be conducted. Minor variations in fuel conditions and micro-climates within the burn may cause some minor, erratic fire behavior from time to time.

Night burning may be employed where conditions will be in prescription at night, but not in the day. These units should be small enough that the burning is completed by the next day when fuel moisture begins to decrease.

Prescribed burns during inversions will be avoided as much as possible.

To the extent possible, wind direction will be used to direct smoke away from roads and highways.

Prior to any man-caused prescription burn the park anthropologist will be informed of the operation and all efforts will be made to survey the area for cultural resources. The park will abide by the edicts of E.O. 11593 in protecting historical and cultural resources in conjunction with its fire program.

Loose Heading Natural Prescribed Fires:

From time to time, a wildfire may occur which meets all the criteria for a natural prescribed fire, with the exception that its location may threaten to escape from the management zone or endanger some cultural resource. At the discretion of the fire management officer, a fire management crew may be called in to put in partial control lines to halt fire spread in a particular direction. This technique gives the fire management officer partial control over the fire, while letting the fire burn as naturally as possible.

Natural Prescribed Fires:

Natural prescribed fire is any fire of natural origin, (caused by lightning), which is allowed to burn under prescribed conditions. The use of natural prescribed fires when possible and practical, is the best fire management technique of restoring fire to its natural role in the environment.

Areas whose past fire history shows a low incidence of fires, and have not been adversly affected by past fire suppression activities, have been placed in fire management zones where natural prescribed fires will be allowed.

Primarily, all of the area below the rim and a good portion of the pinon-juniper forested area will be placed in management zones allowing natural, prescribed fires.

Management fires of this nature will be suppressed when they threaten:

1. Human life.
2. Cultural resources or physical facilities of the park
3. Endangered or threatened species of plants or animals.
4. To escape from management zones
5. To exceed stated prescription
6. To create adverse smoke dispersal.

Natural prescribed fires will be closely monitored a minimum of once a day, and more often, when weather conditions warrant. When possible, monitoring will be carried out by on-site, ground observations. In difficult access areas fires will be monitored by aircraft. The following information should be obtained at least once a day between the hours of 1400 and 1700:

1. Estimate of acreage burned in last 24 hours.

2. Present fire behavior.

3. Direction of spread.

4. Rate of spread.

5. Type fuels on ground.

6. Wind speed, temp., Relative Humidity on-site readings.

7. Fuel moisture reading, if possible.

Monitoring information will be furnished to fire management officer, unit manager or district ranger, superintendent and chief ranger. General Park Service personnel will be informed on acreage burned through Daily Report sheets. Regional Office will be informed on a daily basis.

FIRE MANAGEMENT ZONES
GRAND CANYON NATIONAL PARK

Fire Management Zone A (Pinyon-Juniper)

Area: This zone includes Shiva Temple, Southwest portion of Powell Plateau, the rim at Kanab Creek, the uplands of the Tuweep District, the area west of Grand Canyon Village from Horsethief tank to the Havasupai reservation and the area east of Grand Canyon Village from Buggeln Hill to the east park boundary and north to Cape Solitude. Total acreage in the zone is 89,620 acres. The zone lies between an elevation of 7,200 feet and 5,200 feet.

Vegetation: Primarily pinyon pine and juniper, with small stands of ponderosa pine occuring at higher elevations and on north facing slopes. Ground cover is composed of sagebrush, rabbit brush, grasses and forbs.

Fuels: Fuel accumulations are low, made up of occasional down trees and scattered fine fuels in the form of grasses, forbs and light needle cast. Fuel cover is broken by patches of bare mineral soil and rocks.

Fire Frequency: On the average, five naturally caused fires a year, between May 1 and October 1, occur in this zone. Fire frequency per 10,000 acres per year is 0.56. The majority of fires occurring in this zone are small in size and generally involve only a few trees; however, when fire conditions are extreme and especially when strong winds are present, large acreages could burn. Fuel loadings for the zone range from less than 1 ton to 5 tons per acre.

Fire Management: Because of the low fuel concentrations and the type of vegetation in this zone, fire suppression activities in the past have not significantly altered natural fuel loadings to the point where the zone cannot be returned to a management fire state. Natural prescribed fires will be allowed to burn provided they meet prescription criteria established for the zone. All man-caused fires and all fires not meeting prescription requirements will be suppressed.

Prescription burning in ponderosa pine stands is meant to reduce current fuel loads. Those stands along the South Rim lying between the road and the canyon rim will be included in a natural prescription burn program. Stands of ponderosa lying between the road and the park boundary will be included in the parks prescription burning program, but due to the proximity of U.S. Forest Service lands, all other fires will be suppressed.

Fire Management Zone B (Desert scrub)

Area: This zone consists of all the Inner Canyon below the top of the Redwall limestone, all of Marble Canyon and grasslands in the Tuweep District. The cross-canyon corridor along the Kaibab and Bright Angel Trails is excluded from this zone and part of Zone E. Zone B varies in elevation from 5200 feet to 2000 feet. Total acreage for this zone is 1,012,915.

Vegetation: At the higher elevations are found widely scattered juniper and sage. The Tonto Plateau is covered with a scattered population of sagebrush, blackbrush, desert thorn and burrobrush. Side-canyons contain catclaw, mesquite, saltbrush and cactus. Streamside vegetation is of the type normally found along desert streams characterized by arrow-weed, willow, mesquite and exotic tamarix. With the exception of stream side vegetation, plant density is very low throughout this zone.

Fuel: Fuel loading for the zone is less than a ton per acre. What fuels are present consist of scattered clumps of dried brush and grass. Fuel cover is broken by large stretches of bare rock and very rocky soils.

Fire Frequency: An average one fire occurs per year, generally at the higher elevations of the zone. Fire frequency per 10,000 acres per year is .01.

Fire Management: The area has very low fuel loadings and low fire frequency. Fire suppression activities have not caused any extensive adverse affects on the Inner Canyon area. Natural prescribed fires will be allowed to burn, provided they meet prescription criteria established for the zone. All man-caused fires and all fires not meeting prescription requirements will be suppressed.

Fire Management Zone C (Ponderosa Pine)

Area: Zone includes the ponderosa pine forest of the North Rim on Walhalla, Powell and Rainbow Plateaus, and on Tiyo, Widforss, Sublime and Swamp Points. Elevation varies from 7200 to 8400 feet. Total acreage included in the zone is 46,700 acres.

Vegetation: Mainly ponderosa pine, Gambel oak, locust and aspen, with spruce and fir invading the outer boundaries of the zone.

Fuels: Fuels consist of fallen trees and heavy duff carpeting the forest floor in an almost continuous blanket in many areas. Fuel loadings for the zone range from 5 to 55 tons of fuel per acre.

Fire Frequency & History: An average of 26 naturally caused fires occur per year. Fire season is from June 1 to September 15. Fires have been known to occur in the zone from early April until December 1, depending upon variation in weather patterns. Most of the fires are in the Class A category and are easily suppressed by two to three man fire crews with one to three fires per year exceeding Class B in size. Fire frequency per 10,000 acres per year is 5.7 fires.

Fire Management: Fire suppression activities have caused many significant changes in the natural environment of this zone. Fuel loadings are at unnaturally high levels and a thicket understory has developed. Prescribed burning will be used as a substitute for natural fire to reduce high concentrations of fuels. In areas where fuel loading approximates natural conditions due to previous fire management activities or natural conditions, natural prescribed fires will be allowed to burn provided they meet prescription criteria. All man-caused fires and all fires not meeting prescription requirements will be suppressed.

Fire Management Zone D (Spruce-fir)

Area: Zone lies entirely on the North Rim of Grand Canyon National Park and extends from the north park boundary southward to fire roads W-1 and W-4. Elevation ranges from 8400 to 9200 feet. Total acreage in the zone is 48,640 acres.

Vegetation: Primarily spruce, fir and aspen in the forested areas and a variety of grass in the meadowlands. Zone is densely wooded and contains several large upland meadows.

Fuel: Dead and down woody fuels consist mainly of fallen trees with light needle cast on the ground. Fuel is mixed, with some areas of the zone covered with fallen trees; in other areas, despite the dense forest environment, very little fuel lies on the ground, usually in the form of light needle cast and leaves. The spruce and fir have needle laden branches which reach the ground. Fires starting in this type of vegetation and gaining momentum tend to carry the fire up into the tree crowns, developing fast moving crown fires. Fuel loadings for this zone range from 5 to 55 tons per acre.

Fire Frequency and History: An average of eight fires occur per year. Fire season is from June 1 to September 15. There are few large fires; most fires falling in the Class A and Class B size category. The largest burn to occur at Grand Canyon within the history of the park originated in the spruce-fir forest of the North Rim and then burned into the national forest. This burn exceeded 8,000 acres before it was brought under control. Fire frequency per 10,000 acres per year is 1.6 fires.

Fire Management: Fire suppression activities have caused significant changes in the natural forest environment.

Prescribed burning will be used as a substitute for natural fire to reduce fuel concentrations. All man-caused and natural fires will be suppressed which do not meet prescription criteria.

Fire Management Zone E (Developed Areas)

Area: On the South Rim the zone starts at Horsethief Tank on the west, and extends east, including all the park lands between the rim and the park boundary to Bugglen Hill. The zone covers all land within a mile radius of Desert View. On the North Rim, the zone includes all of Bright Angel Point. An area extending 1 mile in radius around the Tuweep Ranger Station would also be included in this zone.

Vegetation: Because of the wide variation in areas included in this zone, the types of vegetation are numerous. The South Rim and Desert View areas have a combination of pinon-juniper and ponderosa pine forests. Bright Angel point on the North Rim is basically ponderosa pine with some fir and aspen. The area around the Tuweep Ranger Station is composed mainly of grassland with some pinon-juniper present.

Fuels: In the pinon-juniper areas ground fuels average from 1 to 5 tons per acre. In areas where stands of ponderosa pine exist fuel loading varies from 5 to 50 tons per acre. In the grasslands fuel loading is generally less than 1 ton.

Fire Frequency: The South Rim area has about 9 to 10 fires per year with a fire frequency per 10,000 acres per year of 4.4.

Fire Management: This zone was established to identify the developed areas of the park or those areas which continually have high visitor use. At certain times of the year when visitation is low, limited prescribed burning may be carried out in key areas. Under no conditions will natural fires be allowed to burn uncontrolled. All man-caused and wildfires will be suppressed.

SUMMARY OF FUEL DATA IN
MANAGEMENT ZONES. GRAND CANYON NATIONAL PARK

Zones	Elevation	Fuel Cover	Dominant Vegetation	Acreage	Ground Fuels	Fuel loading
A	5200-7200	Broken	Pinyon Juniper	89,620	occasional fallen trees, little duff, some dead grasses.	1-5 ton/acre
B	2000-5200	Broken	Sagebrush grass	1,013,000	Dried brush, scattered grass.	1 ton/acre
C	7200-8400	Uniform	Ponderosa pine	46,700	Fallen trees, deep duff.	5-55 ton/acre
D	8400-9200	Mixed	Mixed spruce fir	48,600	Fallen trees, light duff.	10-55 ton/acre
E	6400-8200	Broken & Uniform	Pinyon Juniper	20,500	From light to heavy duff. Fallen trees, grasses.	1-50 ton/acre

SUMMARY OF BURNING SCHEDULES FOR
MANAGEMENT ZONES - GRAND CANYON NATIONAL PARK

Zones	Fires Per Year	Fire Frequency Per Year Per 10,000 acres	Fire Season	Fire Management Action
A	5	.56	May 1-Oct 1	Allow natural prescribe fires to burn; suppress man-caused fires.
B	1	.01	Apr-Oct 1	Allow natural prescribe fires to burn; suppress man-caused fires.
C	26	5.7	Jun 1-Sep 15	Prescribe burn to reduce fuels; allow natural prescribe fires to to burn in certain areas; suppress man-caused fires.
D	8	1.6	Jun 1-Sep 15	Suppress wildfires; prescribe burn to reduce fuels, when prescription has been developed.
E	9	4.4	May 1-Oct 1	Suppress all fires; carry out prescribed burning in certain areas.

FIRE FIGHTING EQUIPMENT AND MANPOWER

Presently Available at Grand Canyon National Park

Equipment & Manpower

South Rim

- 35 man fire cache
- 1 slip-on pumper unit with truck
- 1 Homelite pumper
- (1) 2000 gallon nurse tanker
- (1) 6000 gallon water truck
- 1 structural fire truck
- (1) 100 gallon Simms bucket for use with helicopter
- 4 man fire management crew

North Rim

- 75 man fire cache
- 2 slip-on pumper units with trucks
- 1 crew cab
- 1 structural fire truck
- 9 man fire management crew

Desert View

- 1 slip-on pumper unit with truck

NOTE: In times of emergency, additional manpower can be taken from the maintenance and protection divisions.

Cooperative Agreement

A cooperative agreement exists between Grand Canyon National Park and the Kaibab National Forest on the suppression of wildfires. This agreemen establishes a mutual aid zone, consisting of a corridor one mile on each side of the mutual boundary between the national forest and the park. Both agencies will send suppression forces in response to reported fires in this zone, unless notified otherwise by the responsible agency.

In addition to initial attack, crews may be provided for fire suppression or standby, upon request of the protecting agency.

Assistance by hire upon a full reimbursement basis may be extended by one agency to the other, regardless of whether the fire is in or outside the mutual aid area or whether any provision for voluntary (non-pay) mutual aid has been made.

DECISION GUIDELINES FOR FIRES IN MANAGEMENT ZONES - GRAND CANYON NATIONAL PARK

LOCATION	CONDITION	MANAGEMENT ACTION
Zone A or B	(a) Prescription met and:	
	- Fire does not threaten public safety, cultural resources, or physical facilities.	Let fire burn
	- Lightning caused.	Let fire burn
	- Less than 2 fires burning at present time.	Let fire burn
	- Smoke dispersal good.	Let fire burn
	- Fire not threatening escape from zone.	Let fire burn
Zone C, D, or E	(b) Prescription Exceeded	Suppress fire
	- Fire threatens public safety, cultural resources or physical facilities.	Suppress fire
	- man caused.	Suppress fire
	- 2 fires presently burning as natural prescribed fires.	Suppress fire
	- Fire threatening escape from zone.	Suppress fire
	- Smoke affecting public safety and well being.	Suppress fire

6. Length of Time Needed: Project, if approved, could be started on a limited basis during summer of 1978 using available park funds. Project will be continued indefinitely; cost will go down as expertise in prescribed burning increases and more land is added to the natural prescribed fire units, reducing the need for further burning.

7. What will happen if not undertaken:

   a. Successional advances will cause vegetation to depart further from its natural state, i.e., without suppression.

   b. Fire hazards will increase.

   c. Disease and insect attacks on trees will increase.

   d. Plant and wildlife habitat will change to unnatural condition.

   e. Incidence of major fires will increase.

   f. Large portions of the open ponderosa pine forest will be crowded out by spruce-fir.

   g. The forest in general will become more crowded as more and more trees fill the open savanna type area.

NATIONAL FIRE DANGER RATING SYSTEM

The National Fire Danger Rating System is the rating system used at Grand Canyon National Park. This procedure integrates the daily fire weather information taken at 1300 each day, with fuel moisture readings and a representative fuel model for the particular area. The system provides three indices designed to aid in evaluating fire danger levels and planning fire control activities.

Three indices are derived from three fire behavior components:

Spread component (SC), Energy Release component (ERC) and Ignition component (IC). The indeces are defined as follows:

Occurrence Index (OI) A number related to the potential fire incidence within a rating area.

Burning Index (BI) A number related to the potential amount of effort needed to contain a fire in a particular fuel type within a rating area.

Fire Load Index (FLI) A number related to the total amount of effort required to contain all fires occurring within a rating area during a specified period.

The NFSRS, along with the daily fire weather forecast, provides fire management personnel with a comprehensive picture of the fire situation in the various fire management zones, and is considered an integrated part of all fire management decision making.

The components of spread and energy release, which combined make up the burning index, provide needed information in projecting fire behavior. The spread component, (SC), integrates the effects of wind and slope together with ground fuel characteristics, to provide data projections on the rate at which a fire front will advance under a given set of conditions. The energy release component (ERC) calculates the combustion rate of fire based on fuel type, fuel moisture and weather condition. This information is needed in determining conditions for prescribed burning, allowing natural fires to burn and in calculating manpower and equipment needs for wildfire suppression.

8. What are the alternatives:

a. Continue the present policy and suppress all fires.

b. Loosely herd or partially control all forest fires.

c. Let all forest fires burn except when they threaten life, physical or cultural resources, or escape the park.

9. Who will Accomplish Project:

Project will be carried out by the initial units with assistance when needed from other units in the park.

10. Administration and Logistics: Men and equipment now used in forest firefighting would be available for use in carrying out this project on a limited basis. Additional funds are needed, however, to carry out prescribe burning, and for monitoring of natural prescribed fires.

Funding	Year in program sequence				
	1st	2nd	3rd	4th	5th
Personal services	$18,000	18,000	18,000	18,000	18,000
Other services	24,000	24,000	24,000	24,000	24,000
Funds available in park base	2,000	2,000	2,000	2,000	2,000
Funds requested from Regional Office	40,000	40,000	40,000	40,000	40,000

Funds requested on form 10-237 January 1976.

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NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park Complex, Western Regional Office

2. PROJECT NAME AND NUMBER: Desert View Boundary Fencing (GRCA-RM-14).

3. STATEMENT OF PROBLEM: Approximately 13 miles of the eastern boundary of the park has not been fenced. This boundary adjoins the Navajo Indian Reservation where horses, cattle, and sheep graze on open range. There is grazing trespass onto park lands. When the Wilderness Bill is passed, approximately 9 miles of this boundary will border on wilderness lands.

   The present park boundary was established by act of Congress on February 25, 1927. Fencing this portion of boundary could create political problems with the Navajo tribe. Mr. Goldtooth, an elderly resident on the Reservation, claims that as a youth, he had a paper giving him title to some of the land within the proposed wilderness area. Park records do not show any inholdings in this area. The Navajo Tribal Council did research their historical files to see if Mr. Goldtooth does have a valid deed with no result. Mr. Goldtooth has subsequently died; no further action on this matter taken.

   Continued grazing trespass creates competition with the native wildlife for available forage and water supplies.

4. WHAT HAS BEEN DONE: A check has been made to determine if the original survey makers are still in place to facilitate surveying. Historical records research is being undertaken to be certain that no private property will be isolated within the fencing project. In 1975, the 13 mile section of boundary was surveyed by private contractors to verify alignment.

5. DESCRIPTION OF THE WORK TO BE UNDERTAKEN: Build approximately 13 miles of four-strand barbed wire fence with steel posts.

6. LENGTH OF TIME NEEDED: This area could be fenced adequately within a period of 3 months.

7. WHAT WILL HAPPEN IF PROJECT NOT UNDERTAKEN: Livestock will continue to damage the wilderness area habitat: the area could become overgrazed, as much of the adjoining reservation lands now are, to a point where natural restoration could not heal the situation, resulting in serious erosion.

8. WHAT ARE THE ALTERNATIVES:

a. Establish an agreement with the people on the Reservation wherein they will be responsible for preventing their livestock from entering park lands. Such an agreement, in fact, would be very difficult to produce, since some of the Navajos do not consider the present boundaries to be valid.

b. Establish an additional position of a boundary patrolman whose duties would include prevention of grazing trespass.

c. Take no action.

9. WHO WILL ACCOMPLISH PROJECT: This project should be accomplished by a fence building contractor.

10. ADMINISTRATION AND LOGISTICS OF THE PROJECT: The contractor will supply all labor, construction equipment, and materials. This project could best be accomplished during the spring and early summer months when the access roads and weather are most suitable to this type of work.

FUNDING	YEAR IN PROGRAM SEQUENCE
	1st
Estimates from the 10-802	
Construction @ $1.50/1.f.	$108,960
Survey	3,000
Working drawings & specifications	15,444
GRAND TOTAL	$127,404
Funds Available in Park Base	0
Funds Requested from Regional Office	127,404

On Form		Date Submitted
10-237	/ /	
10-238	/ X /	October 1976
10-250	/ /	
10-451	/ /	

11. REFERENCES AND CONTACTS

A review of park library records was made. The legislative history of Grand Canyon reveals the original park boundary was established on February 26, 1919.

The park boundary was realigned, the present boundary was established by act of Congress and approved by the President on February 25, 1927.

No local records were found indicating any inholdings along the eastern border of the park.

Two meetings have been held with representatives of the Navajo Tribal Council regarding fencing.

On May 8, 1972, Messrs. Shaw and Valder met with tribal representatives to consider their proposal of installing three relatively short sections of fencing within Grand Canyon National Park to keep livestock from drifting into sections of the park where they create traffic hazards.

Messrs. Shaw and Valder checked with Western Regional Office on the possibility of realigning priorities and getting construction funds for completing the fencing of the park boundary.

At the second meeting with the tribal representatives, they stated that at least one of their people claimed to have title to some lands within the present boundaries of the park. The National Park Service fencing proposal is scheduled with the realization these claims have not been totally resolved.

12. DATE OF SUBMISSION: December 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region.

2. PROJECT NAME AND NUMBER: Sanup Plateau Boundary Survey (GRCA-RM-5).

3. STATEMENT OF PROBLEM: A fencing program is needed to stop trespassing livestock on park lands. This project is designed to control ingress points of livestock from surrounding areas, i.e., Bureau of Land Management lands and Lake Mead National Recreation Area. To establish an accurate boundary, a professional survey is needed.

4. WHAT HAS BEEN DONE: No previous work has been done.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Survey and establish the park boundary, as indicated in P.L. 93-620, along the Sanup Plateau. Mark this line in preparation for fence construction.

6. LENGTH OF TIME NEEDED: 6 months.

7. WHAT WILL HAPPEN IF PROJECT NOT UNDERTAKEN: The park boundary will remain unknown. Encroachment and trespass by adverse users will continue. Control measures aimed at feral burros will be delayed or eliminated from lack of data. Areas where drift fencing is needed will remain unknown. Hunter ingress will continue.

8. WHAT ARE THE ALTERNATIVES:

   a. Erect fences without survey in cooperation with Lake Mead National Recreation Area.

   b. Maintain fence lines in conjunction with wilderness proposals for Lake Mead National Recreation Area.

9. WHO WILL ACCOMPLISH PROJECT: Project should be contracted to NPS team or private survey company.

10. ADMINISTRATION AND LOGISTICS OF THE PROJECT

FUNDING	YEAR IN PROGRAM SEQUENCE
	1st Year
Personnel Services	
Other than Personal Services	$50,000
TOTAL	$50,000
Funds Available in Park Base	-
Funds Requested from Regional Office	$50,000

On Form	Date Submitted
10-237 / X /	October 1976

11. REFERENCES AND CONTACTS

a. National Park Service - Western Region

12. DATE OF SUBMISSION: October 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Sanup Plateau Boundary Fencing (GRCA-RM-6).

3. STATEMENT OF PROBLEM: The addition of U.S. Forest Service and Lake Mead National Recreation Area lands radically increased the size of Grand Canyon National Park. The boundary identified in P.L. 93-620 is vague and raises many questions as to where the park boundary is located exactly. Cattle grazing in lands surrounding the park makes it critical an exact boundary be established. This will involve a fenceline 30 miles long bordering the above two agencies.

4. WHAT HAS BEEN DONE: No previous work has been done.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Construct 30 miles of boundary fence along the new park boundary located on the Sanup Plateau. Fence must consist of five strands of barbed wire to comply with Arizona "fence out" law. This fence must be able to withstand snow depths of 2 feet and must be constructed prior to December 1984. This fence will also prevent possible encroachment of National Park lands by feral burros.

6. LENGTH OF TIME NEEDED: To be determined by survey; GRCA-RM-5.

7. WHAT WILL HAPPEN IF PROJECT NOT UNDERTAKEN: Cattle grazing within the park from other than permittees will continue. Encroachment from possible adverse users remains a potential. The Feral Burro Management Plan will be reduced in its effectiveness.

8. WHAT ARE THE ALTERNATIVES

   a. Do not build a boundary fence.

   b. Identify critical need areas and complete these portions of the boundary until adequate funding can be obtained.

9. PERSONNEL: Project to be contracted.

10. ADMINISTRATION AND LOGISTICS: The contractor will supply all labor, construction equipment, and materials.

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	$384,000 estimated 10/76				
Other than Personal Services					
TOTAL					
Funds Available in Park Base	0				
Funds Requested from Regional Office	$384,000				

On Form	Date Submitted
10-238 / X /	10-76

11. REFERENCES AND CONTACTS

a. National Park Service - Western Regional Office

12. DATE OF SUBMISSION: October 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Pasture Wash Fence Repair (GRCA-RM-7)

3. STATEMENT OF THE PROBLEM: The 22 miles of fenceline separating the park lands from U. S. Forest Service and the Havasupai Indian Reservation is in bad need of repair. Cattle and horses from these lands constantly are grazing on park lands. Hunters trespass on park lands by wandering through fencelines.

4. WHAT HAS BEEN DONE: A "patchup" maintenance program conducted by an assortment of park staff has failed to keep up with the rate of deterioration this fence experiences. During the 1977 summer season the park's contingent of Youth Conservation Corps trainees repaired 2 miles of fence.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Nearly all this fence needs tightening and replacement, and the wood uprights need to be replaced with metal posts. In areas identified as possible bighorn sheep range, the Helvic fence must be installed. Four gates must be installed and rebrushing of the 8-foot clearance must be completed.

6. LENGTH OF TIME NEEDED: 1 year

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: Incroachment of livestock onto park land will continue. Vegetation will be lost, wildlife habitat disturbed and soils changed by trampling. The government will remain liable to livestock lost due to poor fence maintenance. Hunting trespasses will continue.

8. ALTERNATIVES:

   a. Do nothing

   b. Continue with existing "patch-up" programs

9. PERSONNEL: Project to be contracted.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE
	1st
Personnel Services	Work to be contracted
Other than P. S.	-
Funds Available in Park Base	-
Funds Requested From Regional Ofc	$45,000

On Form	Date Submitted
10-237 / /	October 1976

11. REFERENCES AND CONTACTS

a. Division of Resource Management, Grand Canyon National Park.

12. DATE OF SUBMISSION: October, 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: North Rim Boundary Fencing (GRCA-RM-8)

3. STATEMENT OF PROBLEM: The 1975 extension of Grand Canyon National Park to include areas previously administered by Grand Canyon National Monument, the U.S. Forest Service, and Lake Mead National Recreation Area, greatly increased the physical boundary of the park and resulted in the need to install suitable fencing. Snow damage, trespass cattle, hunter encroachment and possible ingress from feral burros all impose a threat to the parks natural environment. The problem of feral burro ingress is especially critical since this has been identified as the number one resource management problem in the park.

4. WHAT HAS BEEN DONE: The boundary was originally fenced by the Civilian Conservation Corps using a barbed wire type fence; later they built a small section of rail fence approximately a mile in length from the entrance station east along the boundary. The area was again fenced in 1965. Extensions of the park in 1975 requires considerably more fence needs.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Rebuild 26 miles of boundary fence using a fence design which can withstand the heavy snow common to the North Rim high elevation areas. Install boundary fence at major cattle encroachment sites and along sections of the park receiving ingress from hunters and feral burro. Where native wildlife need to pass; install fence of special design. Exact locations and lengths of fence will be based on a preliminary survey.

6. LENGTH OF TIME NEEDED: 1 year.

7. WHAT WILL HAPPEN IF PROJECT IS NOT UNDERTAKEN: Cattle grazing in the park will increase. Livestock which have wandered into the park may not be able to find their way back across the fence, resulting in their deaths from lack of water. The down fence will encourage an increase in hunter trespass inside the park. Burro ingress will continue and the park environment will deteriorate more. The Feral Burro Management Plan will be reduced in its effectiveness.

8. WHAT ARE THE ALTERNATIVES: Continue to make fence repairs when manpower and materials are available.

9. WHO WILL ACCOMPLISH PROJECT: Project should be contracted to a fence builder.

10. ADMINISTRATION AND LOGISTICS OF THE PROJECT: The contractor will supply all labor, construction equipment, and materials.

FUNDING	YEAR IN PROGRAM SEQUENCE
	1st
Estimates from the 10-802 construction @ 1.f. $150/1. ft.	$275,000
GRAND TOTAL	$275,000
Funds Available in Park Base	-0-
Funds Requested from Regional Office	$275,000
ON FORM	DATE SUBMITTED
10-238	September 11, 1972

11. REFERENCES AND CONTACTS

a. Resource Management Division, Grand Canyon National Park

b. Unit Manager - North Rim, Grand Canyon

12. DATE OF SUBMISSION: October 1976.

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Kanab Plateau Boundary Fencing (GRCA-RM-9)

3. STATEMENT OF THE PROBLEM: This fence is needed to prevent cattle grazing trespass, hunting/poaching, and other encroachments from occurring on park lands with resultant damage to a fragile ecosystem. Lack of proper protection of these resources has added to some controversy regarding transfer of these lands from National Park status to multiple use management under the jurisdiction of the Bureau of Land Management.

4. WHAT HAS BEEN DONE: Nothing

5. DESCRIPTION OF WORK TO BE DONE: Construct a five strand barbed wire fence along 22 miles of boundary on the Kanab Plateau of Grand Canyon National Park to comply with State of Arizona "fence out" law. This fence must have sufficient posts, guys and stays to withstand winter snow loads of up to 5 feet. In confirmed bighorn sheep areas, fence will be of Helvic construction with a smooth strand of wire on the bottom.

6. LENGTH OF TIME NEEDED: 1 year

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: Cattle and other livestock will continue to trespass park lands. Park vegetation will be destroyed. Bighorn sheep and other wildlife will experience competition from livestock. Hunter trespass will continue based on the excuse that the boundary is not clearly defined.

8. WHAT ARE THE ALTERNATIVES:

   a. Do nothing

   b. Attempt to construct needed fencing through in-park programs

   c. Seek to end cattle grazing on adjoining multi-use lands

9. PERSONNEL: Work to be contracted.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	-	-	-	-	-
Other than Personal Services	$288,000 is the estimated cost of this project as of August 1977. Funds to be used as they become available.				
Funds Available in Park Base					
Funds Requested From Region	-	-	-	-	-

On Form	Date Submitted
10-238 /___/	October, 1976

11. REFERENCES AND CONTACTS:

a. North Rim Unit Manager, Grand Canyon National Park

b. Division of Resource Management, Grand Canyon National Park

12. DATE OF SUBMISSION: October 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region.

2. PROJECT NAME AND NUMBER: Management of Endangered Fish Species (GRCA-RM-10).

3. STATEMENT OF PROBLEM: Presently, two native species of fish found in the park are on the U.S. Fish Wildlife lists for Endangered and Threatened Wildlife. These include the Humpback Chub, Gila cypha, and the Colorado River squawfish, Ptychocheilus lucius. The radical change to the Colorado River ecosystem because of Glen Canyon Dam has eliminated nearly all habitat for these native species and caused an impact on present populations to be deemed critical.

4. WHAT HAS BEEN DONE: As part of the recently completed Colorado River Research Project, basic population trends for these species were established, along with management recommendation from Dr. Royal D. Suttkus of Tulane University; Dr. Robert Miller, University of Michigan; and Charles Minkley, Northern Arizona University.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Continue a monitoring program for these fish species. Close the mouth of the Little Colorado River to all sport fishing. Eliminate the stocking of non-native fish from the waters of Grand Canyon National Park. Establish a "fly-fishing only" regulation in the waters of Grand Canyon National Park.

6. LENGTH OF TIME NEEDED: 1 year for management actions; monitoring activity is continuing.

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: Pressures will continue on existing fish populations probably resulting in their elimination from the park. The park will violate the 1973 Endangered Species Act.

8. WHAT ARE THE ALTERNATIVES:

   a. Do Nothing.

   b. Limit numbers of non-native fish stocked in the Colorado River.

   c. Limit management actions to the Little Colorado River closure.

9. PERSONNEL: Existing Grand Canyon staff.

10. ADMINISTRATION AND FUNDING:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	(To be handled through existing funds and Colorado River Research Monitoring Program, plus Increase Nos. 156 and 162.)				
Other than Personal Services	$800	500	500	500	500
Funds Available In Park Base	300	0	0	0	0
Funds Requested From Region	500	500	500	500	500

On Form	Date Submitted
N/A	

11. REFERENCES AND CONTACTS

a. Colorado River Research Project - N.P.S. Contract No. CX-82106-0006.

b. Dr. Roy Johnson - Grand Canyon National Park.

12. DATE OF SUBMISSION: December 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Rehabilitation of Man-Made Scars, Parkwide, (GRCA-RM-11).

3. STATEMENT OF PROBLEM: The entire park, especially Grand Canyon Village, has sustained high use impact for many years, both from concessions and NPS developments. Little regard has been given to restore these impacted areas to desirable park environmental and aesthetic standards.

   Structures and roads exist which neither serve useful purposes nor conform to aforementioned park standards. Some of these structures pose health and safety hazards to both man and wildlife. Examples are obsolete phone and fence lines, and obsolete housing at Supai Camp. Additionally, unused roads, power and sewer line right-of-ways and old barrow pits are denuded of vegetation and require rehabilitation.

4. WHAT HAS BEEN DONE: Occasional litter clean-up campaigns have been initiated in the past, and sporadic junk removal carried out. In the early 1950's, a small amount of unsuccessful revegetation work was carried out along certain road right-of-ways.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: The houses at Supai Camp should be removed (see Paragraph f, Sec. 10, PL 93-620, Grand Canyon National Park Enlargement Act) and the surrounding grounds cleaned and rehabilitated, including the access road. Work should be undertaken to remove obsolete fences and phone lines around the Pasture Wash area, and to remove old tires, auto parts and assorted junk from the old sewer plant area, at the Village, and from the drainage running from the old dumpsite at Trailer Village to Rowe Well Road. Secondly, various road, sewer, and powerline right-of-ways should be barricaded (consistent with NPS-Arizona Public Service agreements) to prevent further visitor use impact by vehicles, and then vegetatively screened to encourage natural vegetative regeneration. Additionally, manure from park and concession facilities should be spread on these areas to encourage more rapid growth.

   The Desert View dump was phased out in 1975. Heavy equipment filled and rough graded this site. This acre site now needs to be planted with native species and restored to a natural condition. Old road scars need barricades to prevent further damage by visitors driving in these areas. Vegetative screens should also be planted to naturalize these areas. Unneeded fencing and obsolete utilities need to be removed. Some old material sites and stock tanks need to be naturalized and have vehicular access blocked.

6. LENGTH OF TIME NEEDED: This work should be accomplished within 2 years.

7. WHAT WILL HAPPEN IF PROJECT NOT UNDERTAKEN: Public Law 93-620, Sec. 10, paragraph f, declares those lands not held in Havasupai Tribal Trust are to be extinguished. Supai Camp falls within the parameters of this paragraph in that this particular area is not in Tribal Trust but part of the park itself. The obsolete phone line and barbed-wire fencing pose hazards to wildlife, notably bighorn sheep and deer, and restrict their natural ranging tendencies. Bighorn have recently been found killed by downed phone lines in other areas of the park. The old road, sewer and power lines right-of-ways, if not barricaded and rehabilitated, will be continuously used by visitors for illegal camping and pull-offs, posing further law enforcement and fire hazard problems.

   The scars from these sites and remaining junk in other areas will continue to be eye-sores to visitors.

8. WHAT ARE THE ALTERNATIVES: Supai Camp may be left as is, but without inhabitants. Small clean-up projects can be carried out to remove litter. However, the nature of this project calls for more extensive budgeting and manpower. No action would result in a continuing problem.

9. WHO WILL ACCOMPLISH PROJECT: Most of the project (removing phone and fence lines, barricading and fertilizing road, sewer and power line right-of-ways, and junk cleanup) can be accomplished with YCC personnel in the summer. Removal of Supai Camp may be accomplished by park personnel and heavy equipment.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	-	-	-	-	-
Other than Personal Services	10,000	10,000			
Funds Available in Park Base	0	0	0	0	0
Funds Requested from Regional Office	10,000	10,000	-	-	-

On Form	Date Submitted
10-237 / X /	December 1976
10-238 / /	
10-250 / /	
10-451 / /	

11. REFERENCES AND CONTACTS

a. Edmund J. Clancy, Landscape Architect, Grand Canyon National Park.

b. James E. Walters, Resource Management Specialist, Grand Canyon National Park.

c. Memo: From Harry Sloat, Landscape Architect, Western Regional Office, to Edmund J. Clancy, Landscape Architect, Grand Canyon National Park, File #D30.

d. Site and Acreage list attached: Areas to be rehabilitated.

12. DATE OF SUBMISSION: December 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region.

2. PROJECT NAME AND NUMBER: Aircraft Disturbance Research and Management of Noise Problems, (GRCA-RM-12).

3. STATEMENT OF PROBLEM: Present and projected increased air traffic presents what many persons consider intolerable levels of noise within the park. Inner Canyon users, especially, complain about frequency and duration of this outside influence. Low level passes over Grand Canyon Village adversely affect visitors using the rim.

4. WHAT HAS BEEN DONE: Dr. Eldon Bowman, Northern Arizona University, has conducted a 2-year research program measuring aircraft noise. This program was extended for an additional year in an attempt to gather visitor attitudes on noise intrusions.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Control aircraft over the park by scheduling, routing, and restriction to minimize noise and visual disturbance. Maintain the dignity of the park by preserving the magestic area of quiet fitting this natural wonder. This minimization of aircraft noise will also affect the use of park helicopters.

6. LENGTH OF TIME NEEDED: 1 year.

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: The park will continue to be subjected to the adverse impacts of aircraft disturbances. It will also stand in violation of the 1975 Management Policies, the 1975 Grand Canyon Enlargement Act and the Park Service Organic Act.

8. WHAT ARE THE ALTERNATIVES:

   a. Do nothing.

   b. Limit management to restricting present aircraft to present limits and routes.

   c. Stop all flights over the park.

9. PERSONNEL: Existing park staff.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services					
Other than Personal Services	$500	500	500	500	500
Funds Available in Park Base	0	0	0	0	0
Funds Requested From Regional Office	$500	500	500	500	500

On Form	Date Submitted
10-237	/ /
10-238	/ /
10-250	/ /
10-451	/ /

11. REFERENCES AND CONTACTS:

a. Bowman, Eldon, Northern Arizona University.

b. Walters, James E., Resource Management Specialist, Grand Canyon National Park.

12. DATE OF SUBMISSION: December 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Mining and Mineral File Monitoring System, (GRCA-RM-13).

3. STATEMENT OF PROBLEM: Although the mineral development potential for the park is low, rising costs of uranium products warrents close regulation of existing mineral inholdings. Gas and oil leases on the Shivwits and Sanup Plateau sections also present a potential for development.

4. WHAT HAS BEEN DONE: Problems have been handled on a crisis basis by whichever division possessed records. No previous monitoring program has existed.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Consolidate all records and documents into a central file to be administered by the Division of Natural Resources. Establish a monitoring program to insure the park of the exact status, both on record, and in the field of these potential development sites.

6. LENGTH OF TIME NEEDED: 1 year.

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: The park will continue to operate its mining and mineral program on a crisis basis. No centralization of data will exist. The park will continue to depend on regional staff to ascertain its position on these issues.

8. WHAT ARE THE ALTERNATIVES:

   a. Continue under current administration policies.
   b. Assign responsibility to a different division.

9. PERSONNEL: Existing park staff.

10. ADMINISTRATION AND LOGISTICS

FUNDING	YEAR IN PROGRAM SEQUENCE 1st	2nd	3rd	4th	5th
Personal Services	(Program to be funded within existing programs).				
Other than Personal Services	$1000				
Funds Available in Park Base	0				
Funds Requested From Reg. Ofc	$1000				

On Form	Date Submitted
10-237 / X /	October 1976
10-238 / /	(Program to be instigated within existing operation, plus support from Increase Nos. 162 and 137).
10-250 / /	
10-451 / /	

11. REFERENCES AND CONTACTS:

a. Division of Resource Management, Grand Canyon National Park.

12. DATE OF SUBMISSION: December 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region.

2. PROJECT NAME AND NUMBER: Management of Park Caves, (GRCA-RM-14).

3. STATEMENT OF PROBLEM: An unknown number of natural caves having paleontological, archaeological, biological and recreational value exist within the park. These sites also present a definite safety hazard. Sport caving is fast increasing as a park activity. Because of a general lack of knowledge, the park stands to lose both the scientific and aesthetic values of this resource through public misuse. New sites are constantly being located, adding to the management load.

4. WHAT HAS BEEN DONE: Preliminary surveys have been made of several caves by private sport cavers and by members of the Cave Research Foundation. These sites include only a few of the total caves in the park. Fairly extensive paleontological and archaeological research has been conducted in Rampart Cave and Stanton Cave with other sites receiving only salvage investigation, if any at all.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Begin an inventory of all caves. Establish carrying capacities for recreation caves and formulate a management program aimed at preserving these sites. Close all caves having scientific value until they can be evaluated by qualified personnel. Establish a cave use permit system in conjunction with the management plan. Provide for the permanent protection (closure) of caves having extreme scientific value. Instigate a radiation monitoring program.

6. LENGTH OF TIME NEEDED: 2 years.

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: The park will continue to lose these sites through destruction by vandals and pressures from recreational users. Priceless scientific data in the fields of archaeology and paleontology will be lost.

8. WHAT ARE THE ALTERNATIVES:

   a. Do nothing.

   b. Close all caves immediately until research can be funded.

9. PERSONNEL: Existing park staff, contract personnel, Cave Research Foundation, and sport caving organization's volunteers.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE:				
	1st	2nd	3rd	4th	5th
Personal Services	-	-	-	-	-
Other than Personal Services	$10,000	10,000			
	Volunteer individuals and organizations.				
Funds Available in Park Base	0	0	0	0	0
Funds Requested from Region	10,000	10,000	-	-	-

On Form	Date Submitted
10-237 / X /	October 1976
10-238 / /	(Program will be executed within operational base and as funds become available with support from Increase Nos. 162 and 195).
10-250 / /	
10-451 / /	

11. REFERENCES AND CONTACTS:

a. Walters, James E., Resource Management Specialist, Grand Canyon National Park.

b. Cave Research Foundation, Arizona.

12. DATE OF SUBMISSION: December 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Control of Exotic Plants (Tamarisk, Camelthorn, Russian Olive) (GRCA-RM-15).

3. STATEMENT OF PROBLEM: The above species of exotic plants are replacing native species, drying water sources, eliminating beach camping, and changing native habitat.

4. WHAT HAS BEEN DONE: The park has attempted control of camelthorn through the use of volunteer high school students hand grubbing the plants. This project met with mixed success. No attempt at controlling tamarisk or Russian Olive has been made.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Individual Tamarisk plants at critical water areas are to be hand cut and treated with the herbicide Sylvex. Camelthorn, along Colorado beaches, will be hand cut and the roots treated with a herbicide to be determined. Russian Olive will be cut individually and the stumps treated with an appropriate herbicide.

6. LENGTH OF TIME NEEDED: 5 years.

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: Exotic plants will continue to alter the park's native ecosystem. Water holes critical to wildlife will dry through the invasion of Tamarisk. Colorado River beaches will continue to be rendered unuseable through invasion of Camelthorn.

8. WHAT ARE THE ALTERNATIVES:

   a. Do nothing.

9. PERSONNEL: Existing park staff and volunteers.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	$500	500	500		
Other than Personal Services	200	200	200		
Funds Available in Park Base					
Funds Requested From Regional Office	$700	700	700		

On Form		Date Submitted
10-237	/ X /	October 1976
10-238	/ /	(Program to be supported by Increase Nos. 162, 195, and 137.)
10-250	/ /	
10-451	/ /	

11. REFERENCES AND CONTACTS:

a. Johnson, R. Roy, Biologist, Grand Canyon National Park.

b. Walters, James E., Resource Management Specialist, Grand Canyon National Park.

12. DATE OF SUBMISSION: December 1976

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Control of Feral Dogs and Cats, (GRCA-RM-16).

3. STATEMENT OF PROBLEM: Feral dogs and cats in and around the South Rim Village abound, causing a presently unknown impact on native wildlife. Little or no control is exerted against these pests at this time. The National Park Service pet policy does allow park residents pet ownership.

4. WHAT HAS BEEN DONE: The establishment of park regulations and enforcement procedures regarding pets.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: An intensive program of trapping and removal of unclaimed dogs and cats in conjunction with present policies. An intensive program of public relations and control measures will be directed towards all park residents.

6. LENGTH OF TIME NEEDED: 5-years (continuing).

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: Impacts on native wildlife in and around the village will continue. Grand Canyon will stand in violation of feral animal policies developed by the National Park Service.

8. WHAT ARE THE ALTERNATIVES:

   a. Do nothing.
   b. Eliminate pets from the park.
   c. Reduce control efforts to only "obvious" violations.

9. PERSONNEL: Existing park staff.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	(Project to be conducted with existing funds).				
Other than Personal Services					
Funds Available in Park Base	0	0	0	0	0
Funds Requested from Regional Office	$500	500	500	500	500

On Form		Date Submitted
10-237	/ X /	October 1976
10-238	/ /	(Program to be supported by Increase No. 137).
10-250	/ /	
10-451	/ /	

11. REFERENCES AND CONTACTS:

a. Walters, James E. Resource Management Specialist, Grand Canyon National Park.

12. DATE OF SUBMISSION: December 1975.

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Monitor Elk, Pronghorn and Turkey Populations, (GRCA-RM-17).

3. STATEMENT OF PROBLEM: The park maintains an unknown population of elk, pronghorn, and turkey. Nothing is known about these species in reference to population trends, influence of outside hunting and control measures, critical habitat, and ecology. These species are subject to hunting pressures on nearby Forest Service lands. The park presently has no way of measuring impacts on populations from this pressure.

4. WHAT HAS BEEN DONE: Until the early 1970's, the park did operate turkey transects in cooperation with Arizona Game and Fish researchers. Few records of previous pronghorn or elk research exist in the park files.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Establish turkey transects and a monitoring program for pronghorn and elk. Establish a cooperative program with Arizona Game and Fish towards instigating these projects.

6. LENGTH OF TIME NEEDED: Continuing, 5 years.

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: The park will be unable to properly manage these wildlife species. Populations may continue to decrease from controllable, outside influences. Natural fluctuations in populations will remain unmeasurable.

8. WHAT ARE THE ALTERNATIVES:

   a. No action.
   b. Develop population status only on a site record basis.

9. PERSONNEL: Existing park staff.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	(Project to be conducted within programmed funds and as money becomes available).				
Other than Personal Services	$100	1000	1000	1000	1000
Funds Available in Park Base	0	0	0	0	0
Funds Requested from Regional Office	$1000	1000	1000	1000	1000

On Form	Date Submitted
10-237 / X /	October 1976
10-238 / /	(Project to be conducted within programmed funds and as money becomes available, plus Increase Nos. 162, 137, and 195).
10-250 / /	
10-451 / /	

11. REFERENCES AND CONTACTS

a. Walters, James E., Resource Management Specialist, Grand Canyon National Park.

12. DATE OF SUBMISSION: December 1976.

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region.

2. PROJECT NAME AND NUMBER: Control of Exotic birds, (GRCA-RM-18).

3. STATEMENT OF PROBLEM: Exotic species of English sparrows, Rock Doves and Starlings are invading all areas of the park and are endangering native species by taking over of living, nesting and feeding sites. Visitor and stock facilities have created artificial food and habitat beneficial to these exotics. Control measures are needed.

4. WHAT HAS BEEN DONE: Nothing.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Control exotic species populations by nest site control (destruction) and direct reduction by shooting and trapping.

6. LENGTH OF TIME NEEDED: 5 years.

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: Populations of these exotics will continue to increase and compete to the detriment of native species. The park will stand in violation of exotic animal edicts in the 1975 Management Policies handbook.

8. WHAT ARE THE ALTERNATIVES:

   a. Do nothing.
   b. Trap and remove these pest species.

9. PERSONNEL: Existing park staff.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services	-	-	-	-	-
Other than Personal Services	Project to be conducted within existing budget.				
Funds Available in Park Base	0	0	0	0	0
Funds Requested from Regional Office	$100	100	100	100	100

On Form		Date Submitted
10-237	/ X /	October 1976
10-238	/ /	(Program to be supported by Increase Nos. 137 and 195).
10-250	/ /	
10-451	/ /	

11. REFERENCES AND CONTACTS:

a. Walters, James E., Resource Management Specialist, Grand Canyon National Park.

12. DATE OF SUBMISSION: December 1976.

NATURAL RESOURCES PROJECT STATEMENT

1. PARK AND REGION: Grand Canyon National Park, Western Region

2. PROJECT NAME AND NUMBER: Monitor and control tick populations, (GRCA-RM-19).

3. STATEMENT OF PROBLEM: The tick populations on the North Rim have been identified as carriers of relapsing fever and plague. Because of public health considerations, and because of the possible influence of these diseases on Kaibab squirrel populations, a monitoring and control program is needed.

4. WHAT HAS BEEN DONE: A control program has been conducted since 1973 and includes trapping (for analysis of ticks by the Communicable Disease Center - Boulder, Colorado), blood sampling from Kaibab squirrels, and spraying with Bagon 1.5. in the North Rim Village area.

5. DESCRIPTION OF WORK TO BE UNDERTAKEN: Continue the above program.

6. LENGTH OF TIME NEEDED: Continuing, 5-years.

7. WHAT WILL HAPPEN IF NOT UNDERTAKEN: A public health hazard will be perpetuated. Relapsing fever and plague may continue to influence the population of "threatened" Kaibab squirrels.

8. WHAT ARE THE ALTERNATIVES

   a. End the program.
   b. Initiate a massive spraying program.
   c. Monitor blood condition of squirrels.

9. PERSONNEL: Existing park staff.

10. ADMINISTRATION AND LOGISTICS:

FUNDING	YEAR IN PROGRAM SEQUENCE				
	1st	2nd	3rd	4th	5th
Personal Services					
Other than Personal Services	$200	200	200	200	200
Funds Available in Park Base	0	0	0	0	0
Funds Requested from Regional Office	$200	200	200	200	200

On Form		Date Submitted
10-237	/ X /	October 1976
10-238	/ /	(Program conducted within scheduled Resource Management activities and supported by Increase No. 156 and 162.)
10-250	/ /	
10-451	/ /	

11. REFERENCES AND CONTACTS:

    a. Ray, John W., Park Ranger (Resource Management), Grand Canyon National Park.

    b. Walters, James E., Resource Management Specialist, Grand Canyon National Park.

12. DATE OF SUBMISSION: December 1976.

NATURAL RESOURCES PROJECTS PROGRAMMING SHEET
Research Projects*

Grand Canyon National Park — August 1977

NPS Costs Expressed in $1000

Increase or Package No.	Area Priority	Plan Priority & Ref. No.	Project Title	Yr. 1(78) BASE	Yr. 1(78) NEW	Yr. 2(79) BASE	Yr. 2(79) NEW	Yr. 3(80) BASE	Yr. 3(80) NEW	Yr.4 (81) BASE	Yr.4 (81) NEW	Yr. 5 (82) BASE	Yr. 5 (82) NEW	Form No. & Date 10-250	10-237	10-238	No. of Contract
	on going	N-1	Ecological Information Base		50		50		50		50				10-76		
124	85	N-2	Desert Bighorn-Feral Burro Ecology		70		70		70		70				10-76		
196	150	N-3	Predator Ecology Study		50		50		50		50		50		10-76		
130	94	N-4	Backcountry Carrying Capacity Study		50		50		50		50				10-76		
127	131	N-5	Kaibab Squirrel Ecology		6		6		6						10-76		
134	149	N-6	Meadow Restoration & Ecology Study		15		15		15						10-76		
135	125	N-7	Mather Campground Impact Study		7		7		7						10-76		
			(Projects to be carried out within park base and as funds become available)														

BASE - Funds Available in Park Base NEW - Funds Requested from Regional Office Page___ of_

*EXCEPT AS NOTED, THESE PROJECTS ARE PROGRAMMED AND WILL BE CARRIED OUT, ON A PRIORITY BASIS, AS FUNDS BECOME AVAILABLE.

NATURAL RESOURCES PROJECTS PROGRAMMING SHEET

Grand Canyon National Park

August 1977

NPS Costs Expressed in $1000

Increase or Package No.	Area Priority	Plan Priority & Ref. No.	Project Title	Yr. 1(78) BASE	Yr. 1(78) NEW	Yr. 2(79) BASE	Yr. 2(79) NEW	Yr. 3(80) BASE	Yr. 3(80) NEW	Yr.4 (81) BASE	Yr.4 (81) NEW	Yr. 5 (82) BASE	Yr. 5 (82) NEW	Form No. & Date 10-250	10-237	10-238	No. of Contract
		N-8	Monitor Deer Population Trend	.5		.5		.5		.5		.5					
		N-9	Environmental Effects of Stock Use	.5													
		N-10	South Rim Small Mammal Survey	.2		.2		.2		.2		.2					
		N-11	Feasibility Study for Reintroduction of River Otter	1													
		N-12	Identification of Endangered Plants Habitat		.5		.5		.5		.5		.5				
			(Additional Park program supporting research Projects)														
156	77		Biological Research Tech		16		16		16		16		16		10-76		

BASE - Funds Available in Park Base NEW - Funds Requested from Regional Office

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NATURAL RESOURCES PROJECTS PROGRAMMING SHEET

Grand Canyon National Park

MANAGEMENT PROJECT *

August 1977

NPS Costs Expressed in $1000

Increase or Package No.	Area Priority	Plan Priority & Ref. No.	Project Title	Yr. 1(78) BASE	Yr. 1(78) NEW	Yr. 2(79) BASE	Yr. 2(79) NEW	Yr. 3(80) BASE	Yr. 3(80) NEW	Yr.4 (81) BASE	Yr.4 (81) NEW	Yr. 5 (82) BASE	Yr. 5 (82) NEW	Form No. & Date 10-250	10-237	10-238	No. of Contract
(On-going Project)		RM-1	Feral Burro Management Plan Environment Impact Statement Development		30		5										
(On-going Project)		RM-2	Colorado River Management Plan, Environment Impact Statement Development		15												
271	5		Implement River Management Plan		137		137		137		137		137		10/76		
126	64	RM-3	Fire Management Plan		40		40		40		40		40		10/76		
160	10	RM-4	Desert View Boundary Fencing		128											12/76	
190	93	RM-5	Sanup Plateau Boundary Survey		50										10/76		
333	19	RM-6	Sanup Plateau Boundary Fencing		384											12/76	
118	70	RM-7	Repair Pasture Wash Fencing		45										10/76		
227	48	RM-8	North Rim Boundary Fencing		275											9/72	
332	20	RM-9	Kanab Plateau Boundary Fencing		255											10/76	

BASE - Funds Available in Park Base NEW - Funds Requested from Regional Office

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* Projects are programmed and will be carried out in priority order as funds become available.

NATURAL RESOURCES PROJECTS PROGRAMMING SHEET

Grand Canyon National Park — Continued

NPS Costs Expressed in $1000

Increase or Package No.	Area Priority	Plan Priority & Ref. No.	Project Title	Yr. 1(78) BASE	Yr. 1(78) NEW	Yr. 2(79) BASE	Yr. 2(79) NEW	Yr. 3(80) BASE	Yr. 3(80) NEW	Yr.4 (81) BASE	Yr.4 (81) NEW	Yr. 5 (82) BASE	Yr. 5 (82) NEW	Form No. & Date 10-250	10-237	10-238	No. of Contract
(Projects to be carried out within base funds and/or when funds become available)																	
		RM-10	Management of Endangered Fish Species	.3	.5		.5		.5		.5		.5				
		RM-11	Rehabilitation of Man-made Scars		10		10										
		RM-12	Aircraft Disturbance Management		.5		.5		.5		.5		.5				
		RM-13	Mining and Mineral File Monitoring System		1												

BASE - Funds Available in Park Base NEW - Funds Requested from Regional Office

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NATURAL RESOURCES PROJECTS PROGRAMMING SHEET

NPS Costs Expressed in $1000

Increase or Package No.	Area Priority	Plan Priority & Ref. No.	Project Title	Yr. 1(78) BASE	Yr. 1(78) NEW	Yr. 2(79) BASE	Yr. 2(79) NEW	Yr. 3(80) BASE	Yr. 3(80) NEW	Yr.4 (81) BASE	Yr.4 (81) NEW	Yr. 5 (82) BASE	Yr. 5 (82) NEW	Form No. & Date 10-250	10-237	10-238	No. of Contract
		RM-14	Management of Park Caves		10		10										
		RM-15	Control of Exotic Plants		.7		.7		.7								
		RM-16	Control of Feral Dogs/Cats		.5		.5										
		RM-17	Monitor Elk,Pronghorn & Turkey Population		1		1		1		1		1				
		RM-18	Control of Exotic Birds		.1		.1		.1		.1		.1				
		RM-19	Monitor & Control Tick Populations		.2		.2		.2		.2		.2				
	(Other	Programs	supporting resource management Projects)														
137	139		Resource Management Technician		19		19		19		19		19		10-76		
195	140		Resource management Specialist		23		23		23		23		23		10-76		
162	37		Restore Deferred Resource Managment Programs		40		40		40		40		40		10-76		

BASE - Funds Available in Park Base NEW - Funds Requested from Regional Office

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*U.S. GPO: 1977-792-8

U. S. DEPARTMENT OF THE INTERIOR
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